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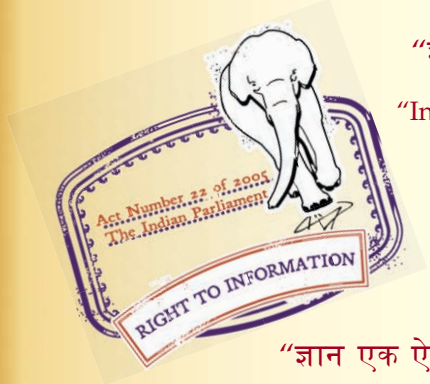
IS 12223-1 (1987): 6.30 mm Wide Magnetic Tape Cartridge Using IMFM Recording, Part 1: Mechanical, Physical and Magnetic Properties [LITD 16: Computer Hardware, Peripherals and Identification Cards]



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Bhartṛhari—Nītiśatakam
"Knowledge is such a treasure which cannot be stolen"

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IS : 12223 (Part 1) - 1987
ISO 8063/1 - 1986

(Reaffirmed 2003)

Indian Standard

SPECIFICATION FOR 6·30 mm WIDE MAGNETIC TAPE CARTRIDGE USING IMFM RECORDING

PART 1 MECHANICAL, PHYSICAL AND MAGNETIC PROPERTIES

[ISO Title : Information Processing — Data Interchange on 6·30 mm (0·25 in) Wide Magnetic Tape Cartridge Using IMFM Recording at 252 ftpmm (6 400 ftpi) — Part 1: Mechanical, Physical and Magnetic Properties]

UDC 681.327.636:621.317.4

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IS : 12223 (Part 1) - 1987
ISO 8063/1 - 1986

Indian Standard

SPECIFICATION FOR 6·30 mm WIDE MAGNETIC TAPE CARTRIDGE USING IMFM RECORDING

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National Foreword

This Indian Standard (Part 1) which is identical with ISO 8063/1-1986 'Information processing — Data interchange on 6·30 mm (0·25 in) wide magnetic tape cartridge using IMFM recording at 252 ftpmm (6 400 ftpi) — Part 1 : Mechanical, physical and magnetic properties', issued by the International Organization for Standardization (ISO), was adopted by the Bureau of Indian Standards on the recommendation of the Computers, Business Machines and Calculators Sectional Committee and approval of the Electronics and Telecommunication Division Council.

In the adopted standard certain terminology and conventions are not identical with those used in Indian Standards; attention is specially drawn to the following:

a) Comma (,) has been used as a decimal marker while in Indian Standards the current practice is to use a point (.) as the decimal marker.

b) Wherever the words 'International Standard' appear referring to this standard, they should be read as 'Indian Standard'.

c) For the purpose of Indian Standard, metric dimensions are applicable.

Cross References

International Standard	*Corresponding Indian Standard*
ISO 646-1983 Information processing — ISO 7-bit coded character set for information interchange	IS : 10315-1982 7-bit coded character set for information interchange (Technically equivalent)
ISO 4873-1979 Information processing — ISO 8-bit code for information interchange-structures and rules for implementation	IS : 10401-1982 8-bit coded character set for information interchange (Technically equivalent)

The Computers, Business Machines and Calculators Sectional Committee has reviewed the provisions of the following ISO standards and has decided that these are acceptable for use in conjunction with this standard:

ISO 2022 Information processing — ISO 7-bit and 8-bit coded character sets — Code extension techniques

ISO 4341 Information processing — Magnetic tape cassette and cartridge labelling and file structure for information interchange

Adopted 26 August 1987

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1 Scope and field of application

ISO 8063 specifies the characteristics of a tape cartridge using 6,30 mm (0.25 in) wide magnetic tape for data interchange between data processing systems.

ISO 8063/2 specifies the quality of the recorded signals, and the track format to be used on a 6,30 mm (0.25 in) magnetic tape cartridge recorded at 252 ftpmm (6 400 ftpi) using IMFM recording and the start/stop mode of operation.

This part of ISO 8063 specifies the dimensional, physical and magnetic characteristics of the cartridge, and the track layout.

Together with the labelling scheme specified in ISO 4341, ISO 8063/1 and ISO 8063/2 provide for full data interchange between data processing systems.

NOTE — Numeric values in the SI and/or Imperial measurement system in this part of ISO 8063 may have been rounded off and therefore are consistent with, but not exactly equal to, each other. Either system may be used, but the two should be neither intermixed nor reconverted. The original design was made using the Imperial measurement system.

ISO 8063 applies to cartridges used for data interchange. Where it applies for testing only, this is specifically stated.

2 Conformance

A 6,30 mm (0.25 in) wide magnetic tape cartridge shall be in conformance with ISO 8063 if it meets all mandatory requirements of both ISO 8063/1 and ISO 8063/2.

3 References

ISO 646, *Information processing — ISO 7-bit coded character set for information interchange.*

ISO 2022, *Information processing — ISO 7-bit and 8-bit coded character sets — Code extension techniques.*

ISO 4341, *Information processing — Magnetic tape cassette and cartridge labelling and file structure for information interchange.*

ISO 4873, *Information processing — ISO 8-bit code for information interchange — Structure and rules for implementation.*

4 Definitions

For the purpose of ISO 8063 the following definitions apply.

4.1 magnetic tape: A tape which accepts and retains magnetic signals intended for input/output and storage purposes of information processing and associated systems.

4.2 Reference Tape Cartridge: A tape cartridge selected for a given property for calibrating purposes.

4.3 Secondary Reference Tape Cartridge: A tape cartridge intended for routine calibrating purposes, the performance of which is known and stated in relation to that of the reference tape cartridge.

4.4 Typical Field: The minimum field which, when applied to the tape under test, causes a signal output equal to 95 % of the maximum signal output at the specified test density.

4.5 Reference Field: The minimum field which, when applied to the signal amplitude reference tape cartridge, causes a signal output equal to 95 % of the maximum signal output at the test density.

4.6 Test Recording Current: The recording current between 148 % and 152 % of the current required to produce the reference field at 252 ftpmm (6 400 ftpi).

4.7 Signal Amplitude Reference Tape Cartridge: A reference tape cartridge selected as a standard for signal amplitude and reference field.

NOTE — A Master Standard (Computer Amplitude Reference) Cartridge has been selected by the US National Bureau of Standards (NBS) to establish the reference level for average peak-to-peak signal amplitudes when recorded at

252 ftpmm (6 400 ftpi),

394 ftpmm (10 000 ftpi).

Secondary Standard Amplitude Reference Tape Cartridges are available from NBS under Part Number SRM 3217.[1)]

4.8 Average Signal Amplitude: The average peak-to-peak value of the signal output measured over at least 4 000 flux transitions.

4.9 Standard Reference Amplitude (SRA): The average peak-to-peak signal amplitudes of the Signal Amplitude Reference Tape Cartridge.

SRA_{252} is the average peak-to-peak signal amplitude when recording at 252 ftpmm (6 400 ftpi) using the appropriate Test Recording Current.

4.10 in-contact: An operating condition in which the magnetic surface of a tape is in physical contact with a magnetic head.

4.11 track: A longitudinal area of the tape along which a series of magnetic signals may be recorded.

4.12 physical recording density: The number of recorded flux transitions per unit length of track: flux transitions per millimetre (ftpmm) [flux transitions per inch (ftpi)].

4.13 data density: The number of data characters stored per unit length of tape; characters per millimetre (cpmm) [characters per inch (cpi)].

4.14 position of flux transitions: The position which exhibits the maximum free space flux density normal to the tape surface.

4.15 erasing field: A field of sufficient strength to remove the signals from the tape.

4.16 recording area: That part of the tape satisfying the requirements for magnetic properties.

5 Environment and transportation

5.1 Testing environment

Tests and measurements made on the cartridge to check the requirements of this part of ISO 8063 shall be carried out under the following conditions:

temperature: 23 ± 2 °C (73 ± 4 °F);

relative humidity: 40 % to 60 %;

wet-bulb temperature: 18 °C max. (64 °F max.);

conditioning before testing: 24 h min.

5.2 Operating environment

Cartridges used for data interchange shall be operated under the following conditions:

temperature: 5 to 45 °C (41 to 113 °F);

relative humidity: 20 % to 80 %;

wet-bulb temperature: 26 °C max. (79 °F max.);

The temperature shall be measured in the air immediately surrounding the cartridge. Rapid temperature variations should be avoided. There shall be no deposit of moisture on or in the cartridge.

5.3 Storage environment

During storage it is recommended that recorded cartridges are kept within the following conditions:

temperature: 5 to 45 °C (41 to 113 °F);

relative humidity: 20 % to 80 %;

wet-bulb temperature: 26 °C max. (79 °F max.);

5.4 Transportation

5.4.1 Transportation environment

During transportation, the cartridge may have been exposed to conditions outside the operating environment. It is recommended that the following conditions are not exceeded:

temperature: −40 °C to 45 °C (−40 to 113 °F);

relative humidity: 20 % to 80 %;

wet-bulb temperature: 26 °C max. (79 °F max.).

5.4.2 Transportation procedures

Responsibility for ensuring that adequate precautions are taken during transportation shall be with the sender. For transportation a rigid container free from dust or extraneous matter shall be used. The final package shall have a clean interior and a construction preventing ingress of dust or water. It is recommended that a sufficient space exists between cartridge and outer surface of the final container, so that risk of damage due to stray magnetic fields will be negligible.

1) NBS , Office of Standard Reference Materials, Room 311, Chemistry Building, Gaithersburg, M.D. 20899, USA.

5.5 Conditioning of the cartridge

Before use the cartridge shall be conditioned by exposure to the operating environment for a time at least equal to the period during which it has been out of the operating environment (up to a maximum of 8 h).

The cartridge shall also be conditioned by running the tape one complete end-to-end pass in any of the following cases:

a) each time it is inserted in a drive;

b) after prolonged operation over a limited area;

c) when the temperature change to which the cartridge has been exposed is greater than 17 °C (30 °F).

5.6 Flammability

Tape or cartridge components shall be made from materials that, if ignited from a match flame, do not continue to burn in a still carbon dioxide atmosphere.

5.7 Toxicity

Tape or cartridge components which may cause bodily harm by contact, inhalation or ingestion during normal use of the cartridge shall not be used.

6 Characteristics of the tape

6.1 Mechanical properties

6.1.1 Tape width

The width of the tape shall be

$6{,}30\ ^{0}_{-0{,}06}$ mm (0.247 0 $^{+0.001\ 0}_{-0.001\ 5}$ in)

NOTE — Although the tolerances are expressed differently in the two measurement systems, the dimensions are equivalent.

6.1.2 Tape length

The length of the tape between the LP and the EW markers (see 6.1.4) shall be

$137{,}0\ ^{+\ 4{,}6}_{\ \ 0}$ m ($450\ ^{+\ 15}_{\ \ 0}$ ft)

6.1.3 Tape thickness

The thickness of the tape and of its coating shall be

— overall thickness: 19 µm nom. (0.000 75 in nom.)

— coating thickness: 6,6 µm max. (0.000 26 in max.).

6.1.4 Markers

On the tape there shall be a number of markers, the relative positions of which are shown in figure 2.

6.1.4.1 Beginning-of-tape (BOT)

A BOT marker shall be a pair of circular holes punched in the tape. There shall be three such markers, the innermost of which is used for the purpose of identifying the storage position for the cartridge. In the storage position, all of the recording area shall be wound on the supply hub and shall be protected by at least one layer of tape. The two other markers shall be used to ensure reliability of detection.

The diameter of the BOT holes shall be

1,17 ± 0,05 mm (0.046 ± 0.002 in).

6.1.4.2 End-of-Tape (EOT)

An EOT marker shall be a single circular hole punched in the tape. There shall be three such markers along a single line. The first to pass the photo sensor during forward operation indicates that the recording area has been exceeded. The two other markers shall be used to ensure reliability of detection.

The diameter of the EOT holes shall be

1,17 ± 0,05 mm (0.046 ± 0.002 in).

6.1.4.3 Load-Point (LP)

The LP marker shall be a single circular hole punched in the tape to indicate the beginning of the recording area in the forward direction.

The diameter of the LP hole shall be

1,17 ± 0,05 mm (0.046 ± 0.002 in).

6.1.4.4 Early-Warning (EW)

The EW marker shall be a single circular hole punched in the tape for the purpose of indicating the approaching end of the recording area in the forward direction. Recording shall stop before the EOT marker is sensed.

The diameter of the EW marker shall be

1,17 ± 0,05 mm (0.046 ± 0.002 in).

6.1.5 Light transmittance

The tape shall have a light transmittance of less than 0,5 % measured according to annex A.

6.1.6 Tensile yield force

The tensile yield force of the tape, defined as the force required to elongate a sample by 3 %, shall be 6,7 N min. (1.5 lbf min.).

This elongation shall be measured with a static weighing tester at a constant rate of grip separation. A specimen of tape of at least 178 mm (7 in) shall be clamped with an initial separation of 102 mm (4 in) between the jaws. This specimen shall be elongated at a rate of 51 mm/min (2 in/min) until an elongation of at least 10 % is reached. The tensile yield force is the force required to produce the elongation of 3 %.

6.1.7 Layer-to-layer adhesion

Layer-to-layer adhesion shall be sufficiently low to meet the requirements of the test in annex B.

6.1.8 Cupping

Cupping is the departure across a tape (transversely to the tape motion) from a flat surface.

The maximum cupping of a 6,30 mm (0.25 in) long length of tape shall not exceed 0,38 mm (0.015 in) when placed concave side down on a smooth, flat surface. The time between cutting and the measurement shall be at least 1 h.

6.1.9 Leaders and splices

The cartridge shall contain no splices or spliced-in leaders.

6.1.10 Tape wind

The tape shall be wound on the hubs with the magnetic coating on the outside, and in such a way that during forward read/write operations the tape is unwound in a counter-clockwise direction viewed from above as shown in figure 3.

6.2 Electrical surface resistance

The electrical surface resistance of the magnetic surface of any square sample of the tape shall be within the range of

5×10^5 to $10^9\ \Omega$

measured between electrodes placed on two opposite sides of the square, using a voltage of 500 ± 10 V.

6.3 Magnetic properties

The magnetic properties of the tape are defined by the testing requirements given below. When performing the tests, the output or resultant signal shall be measured on the same relative pass for both the Signal Amplitude Reference Tape Cartridge and the tape under test (i.e. either the read-whilst-write, or on equipment without read-whilst-write capability, on the first forward-read-pass) on the same equipment.

The in-contact condition shall be used for all tests.

6.3.1 Test density

The test density shall be 252 ftpmm nom. (6 400 ftpi nom.).

6.3.2 Test tracks

Testing shall be carried out on four tracks numbered 1 to 4. Track designation, location and width are specified in clause 7.

6.3.3 Typical field

The typical field of the tape under test shall be within ± 20 % of the Reference Field.

6.3.4 Average signal amplitude

When a tape has been recorded with the appropriate Test Recording Current, then played back on a system which has been calibrated by means of a Signal Amplitude Reference Tape Cartridge recorded under the same conditions, the Average Signal Amplitude of the tape under test shall be within ± 25 % of SRA_{252}.

6.3.5 Ease of erasure

When a tape has been recorded at 63 ftpmm (1 600 ftpi) with a recording current equal to 150 % of the Test Recording Current, and then passed through a longitudinal steady erasing field of 79 600 A/m (1 000 Oe), any remaining signal shall not exceed 3 % of the Standard Reference Amplitude SRA_{252}. The erasing field shall be reasonably uniform, for example the field in the middle of a solenoid. The measurement shall be made with a band pass filter passing at least the first three harmonics.

6.3.6 Test for missing pulses

This test shall be carried out on the test tracks in the in-contact condition and over the whole length of the recording area (see 6.3.8) using the Test Recording Current.

Any playback signal, when measured base-to-peak, which is less than 40 % of half SRA_{252} shall be a missing pulse.

NOTE – ISO 8063 does not specify a test for extra pulses as it has no relevance to the recording method IMFM specified in ISO 8063/2.

6.3.7 Rejected regions

A rejected region shall be an area of tape which exhibits missing pulses. The acceptable number of rejected regions is a matter of agreement between the parties concerned (see annex F).

6.3.8 Recording area

The recording area shall be that part of the tape tested according to 6.3.1 to 6.3.6. In the forward direction, it begins at least 686 mm (27 in) before the LP marker and ends at least 991 mm (39 in) after the EW marker (see figure 2).

7 Layout of tracks (see figure 1)

7.1 Reference plane B and reference edge

All positioning requirements shall be referred to the top of the base plate of the cartridge, which is reference plane B. The reference edge shall be the edge of the tape positioned at a distance from reference plane B

l_0 = 1,78 ± 0,01 mm (0.070 0 ± 0.000 5 in).

7.2 Number of tracks

There shall be four parallel tracks numbered track 4, track 1, track 2, and track 3. Track 4 is the track nearest to the reference edge, track 3 being the track farthest from the reference edge.

7.3 Track centreline location

The track centreline locations shall be

- for track 1: l_1 = 4,11 ± 0,20 mm (0.162 ± 0.008 in);
- for track 2: l_2 = 5,74 ± 0,20 mm (0.226 ± 0.008 in);
- for track 3: l_3 = 7,37 ± 0,20 mm (0.290 ± 0.008 in);
- for track 4: l_4 = 2,48 ± 0,20 mm (0.098 ± 0.008 in).

7.4 Track width

The track width shall be

0,914 ± 0,050 mm (0.036 ± 0.002 in).

8 Characteristics of the cartridge

8.1 General description

The cartridge shall be of a compact coplanar design with the tape and hubs completely enclosed by the casing, except for the belt capstan and the head openings. The drive shall be by means of a tensioned belt which is driven by the internal belt capstan which receives motion from an external motor (see figure 3). Tape guides shall be located inside the cartridge. A clear plastic top shall allow visual monitoring of the tape and shall not extend beyond the base except at the notches.

8.1.1 Dimensions

The dimensions of the cartridge shall be as shown in figure 4.

8.1.2 Cartridge positioning planes

The cartridge shall be referenced to the drive only in the cross-hatched areas shown in figure 5. The application of forces indicated by *F* and *F* in figure 5 is one method of ensuring correct registration of the cartridge to the positioning plane of the drive.

8.1.3 Attachment

The ends of the tape shall not be attached to the hubs.

8.1.4 Mounting position

It shall be possible to mount the cartridge in the drive in one position only; to ensure this, the cartridge shall have the following asymmetrical features (see figure 4):

a) a projection in one guide slot;

b) the guide slots shall be accessible on the head opening edge only.

8.1.5 Light sensing

The cartridge shall contain optical elements to permit photoelectric detection of the tape markers (see figure 6). The total light transmittance of both cover windows, including the effects of reflection from the mirror surface, sensed by a silicon photo-transistor shall be at least 50 %

This requirement shall be satisfied for both

a) 2 000 ± 200 K incandescent light source, and

b) a 940 ± 50 nm LED light source.

8.1.6 Cartridge-in-position sensing

The cartridge shall have a flat area on the front surface, the dimensions of which are shown in figure 7. This area shall be used for mechanical sensing that the cartridge is in position for writing and reading.

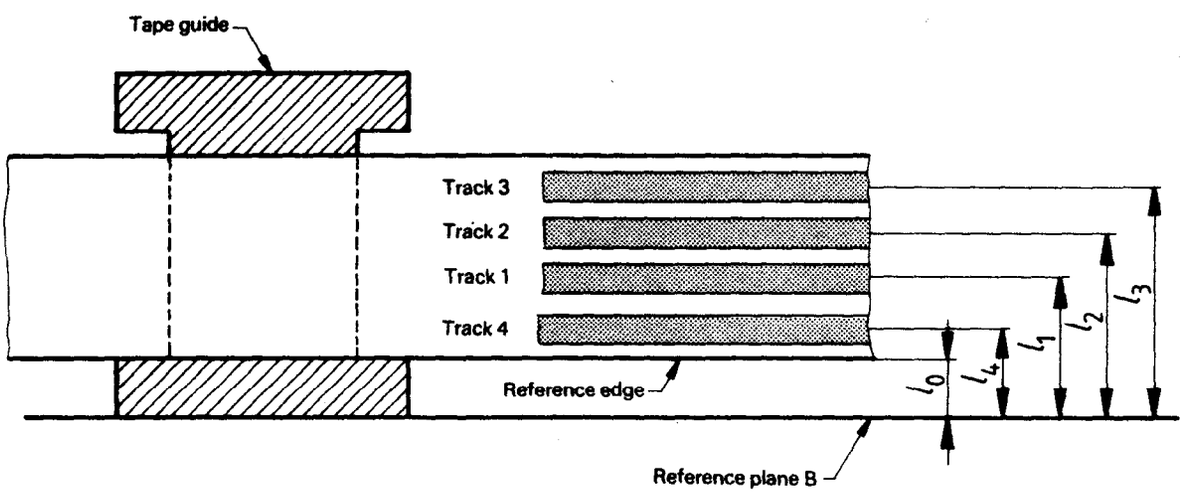


Figure 1 — Layout of tracks

8.1.7 Cartridge door

The cartridge shall have a door for protection of the tape during storage and transport. Requirements for opening the door are shown in figure 8.

8.2 File protection

The cartridge shall have a rotatable plug to prevent writing or erasing the tape, located as shown in figure 7.

8.3 Physical labels

8.3.1 Location and size

The rear surface of the cartridge, opposite the exposed tape, and a part of the top side of the cartridge shall allow the use of labels (see figure 9).

8.3.2 Interchange

Labels shall be used for marking the contents of cartridges. The use of pencil or erasable material is not permitted.

8.4 Tape guides

The tape shall be guided by tape guides contained within the cartridge (see figure 10). The drive shall not restrict the tape path in the transverse direction.

8.5 Speed

The cartridge shall be capable of being used at any nominal tape speed in the range 0,76 m/s (30 in/s) to 2,29 m/s (90 in/s).

NOTE — When using the higher speeds reliable data transfer is especially dependent on the careful design of the head-to-tape contact.

8.6 Instantaneous Speed Variation (ISV)

An Instantaneous Speed Variation Event is said to have occurred when the residual Time Displacement Error (TDE) exceeds 156 ns when measured at 0,76 m/s (30 in/s) and 252 ftpmm (6 400 ftpi). The number of ISV events shall be a matter of agreement between the parties concerned.

See Annex C for the method of test.

8.7 Acceleration

The cartridge shall be capable of withstanding any acceleration and deceleration of the tape up to a maximum of 50,8 m/s^2 (2 000 in/s^2).

8.8 Driving force

The tangential force required at the external driving surface of the belt capstan to maintain a constant operating speed shall be 1,0 ± 0,3 N (3.5 ± 1.0 ozf). The external radial load applied to the belt capstan when making this measurement shall be 5,6 ± 0,6 N (20 ± 2 ozf).

8.9 Total inertia

The total equivalent mass of all moving cartridge elements, when measured at the external driving surface of the capstan, shall be 0,022 kg max. (0.002 ozf·s^2/in max.).

8.10 Dynamic response

8.10.1 Definition

The speed response of tape motion to a step driving function applied to the belt capstan.

8.10.2 Requirement

The natural resonant frequency shall be a least 60 Hz.

8.10.3 Procedure

A drive capable of producing a pronounced overshoot of the tape speed should be used. The drive servo should be critically damped so that the overshoot observed is not that of the drive. The reciprocal of the time measured between the first two overspeed peaks is the natural resonant frequency.

8.11 Tape tension

8.11.1 Definitions

8.11.1.1 tape tension: The resultant force in the longitudinal direction of the tape on a cross-section of the tape taken through the tape perpendicular to the longitudinal direction.

8.11.1.2 instantaneous tension: The tape tension as measured at the cross-section of the tape located at the head position of the free tape path and averaged over 10 ms.

8.11.1.3 average tension (at a point along the length of the tape): The average value of instantaneous tension measured over 1 m (3 ft) of tape symmetrically located around that point

8.11.1.4 dynamic tape tension (at a point along the length of the tape): The maximum variation of instantaneous tension over 1 m (3 ft) of tape symmetrically located around that point

8.11.1.5 transverse tape tension variation: That variation of average tension across the tape produced by the difference in free tape path length between the two edges of the tape.

8.11.2 Requirements

8.11.2.1 Value of instantaneous tension

a) In the testing environment the instantaneous tension any point along the length of the tape between LP and E shall be between 0,28 N (1.0 ozf) and 0,98 N (3.5 ozf).

b) In the operating environment the instantaneous tension shall be between 0,14 N (0.5 ozf) and 1,12 N 4.0 ozf). When the temperature is brought back to that of the testing environment the requirements of a) shall be met.

8.11.2.2 Value of dynamic tension

The dynamic tension at any point along the length of the tape between LP and EW shall not exceed 0,21 N (0.75 ozf).

8.11.2.3 Requirement for transverse tension variation

The test rod shall not deviate from the horizontal by more than 4° at any point along the length of the tape from LP to EW.

8.11.3 Procedures

For test procedures, see annex D.

8.12 Drive ratio

The ratio of the tape speed to the surface speed of the external driving surface of the belt capstan shall be 0,76 ± 0,02.

8.13 Tape path length

The cartridge shall be used with drives causing an increase of the tape path length in the range 0,38 to 1,40 mm (0.015 to 0.055 in).

NOTE – The length of the tape path is the length of the straight tangent common to the tape guides when the cartridge is not mounted in the drive. It is measured between the two contact points of the tape with the guides. When the cartridge is mounted in the drive, the head and/or other parts of the drive provoke an increase of this tape path length which affects the initial tape tension.

8.14 Electrical resistance of the belt capstan

The electrical resistance of the belt capstan shall not exceed 1 MΩ when measured using the test equipment and test procedures described in annex E.

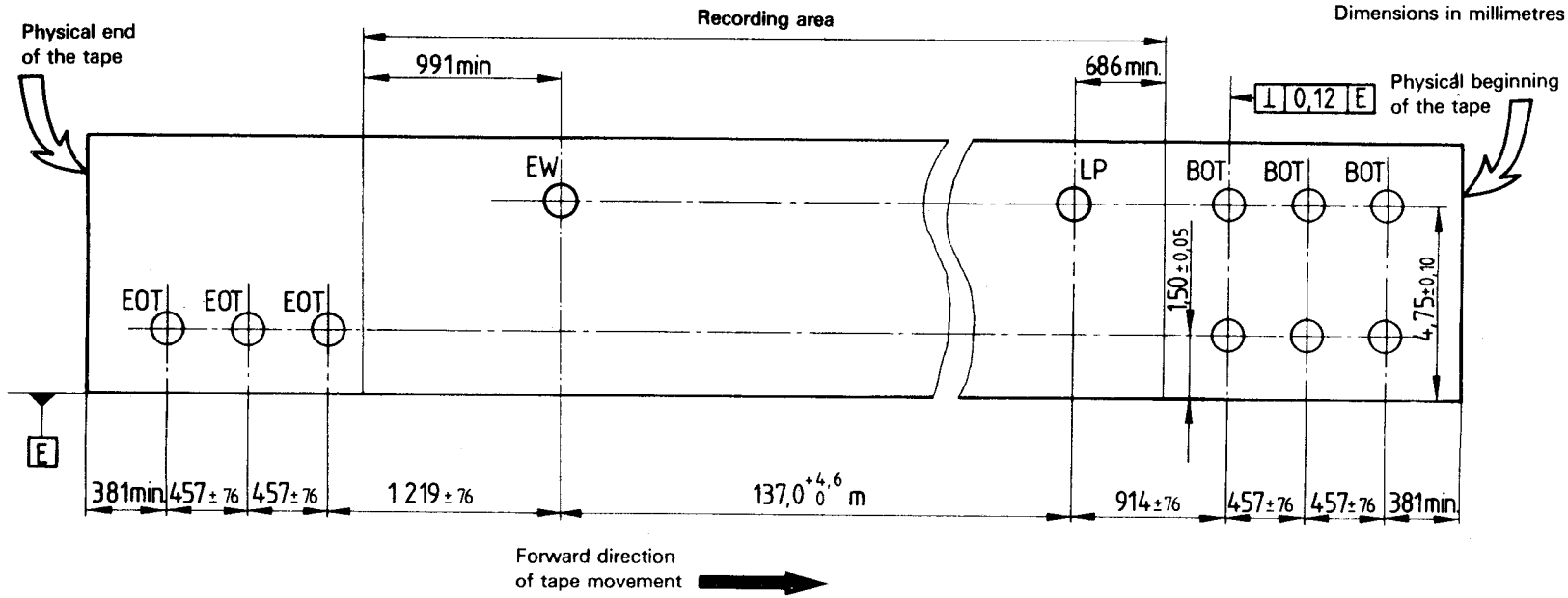


Figure 2a) — Position of the markers and recording areas (magnetic surface shown)

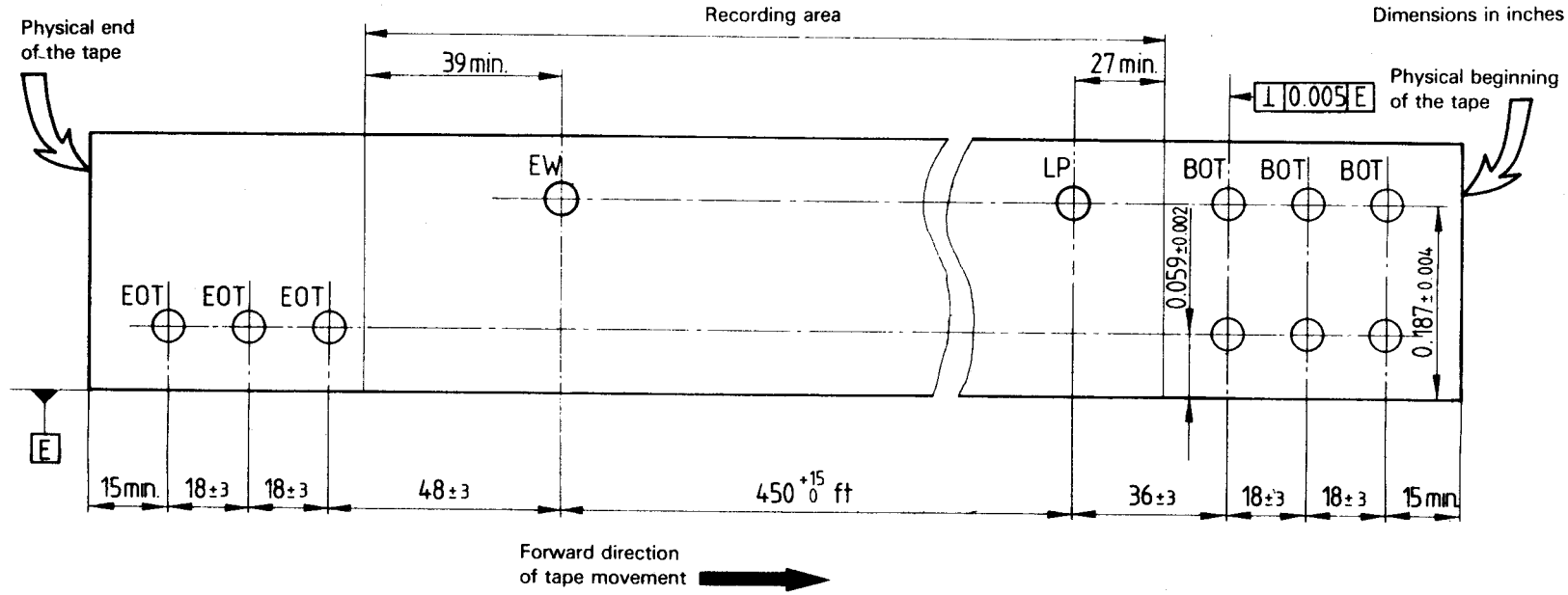


Figure 2b) — Position of the markers and recording areas (magnetic surface shown)

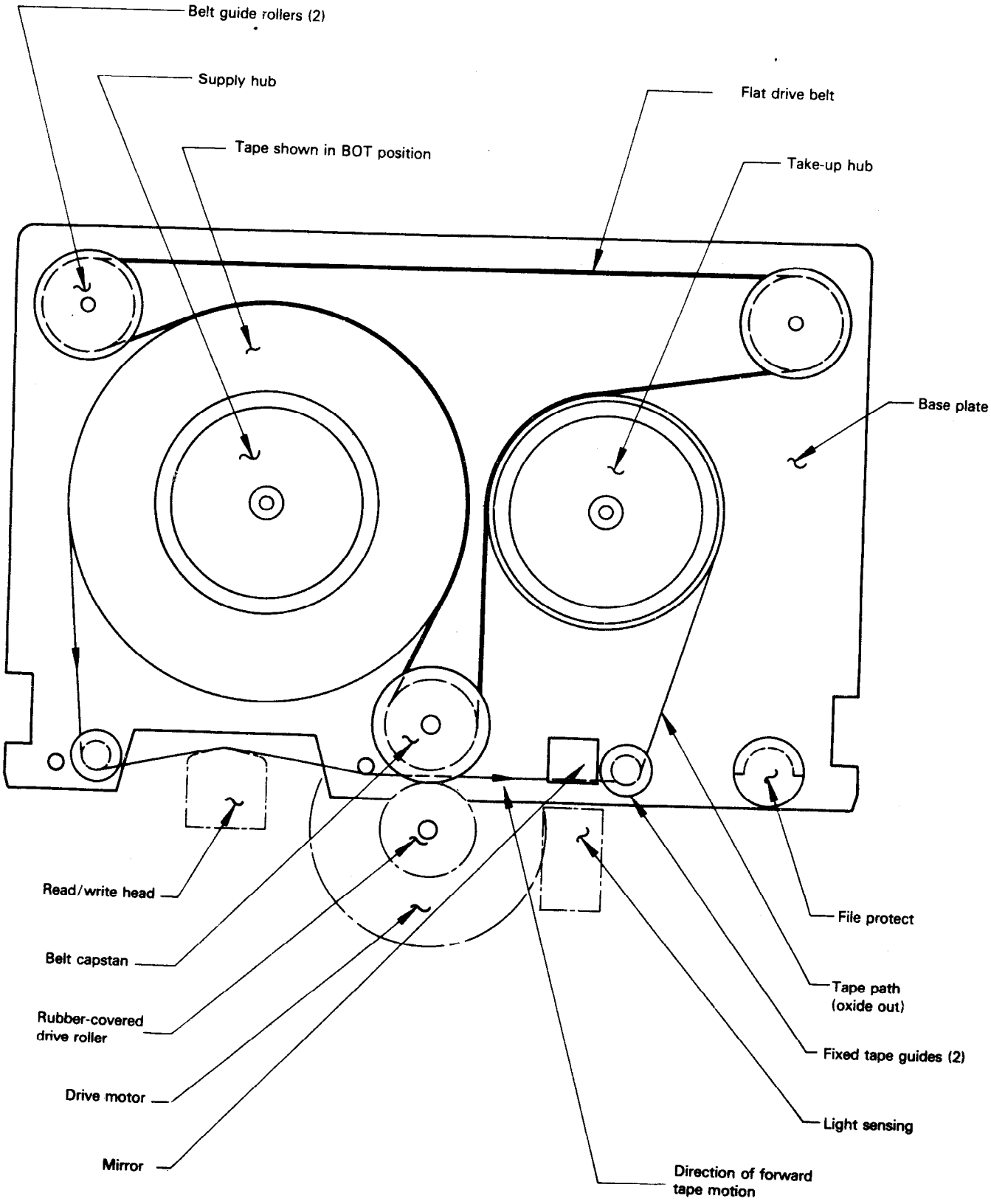


Figure 3 — Cartridge diagram

Dimensions in millimetres

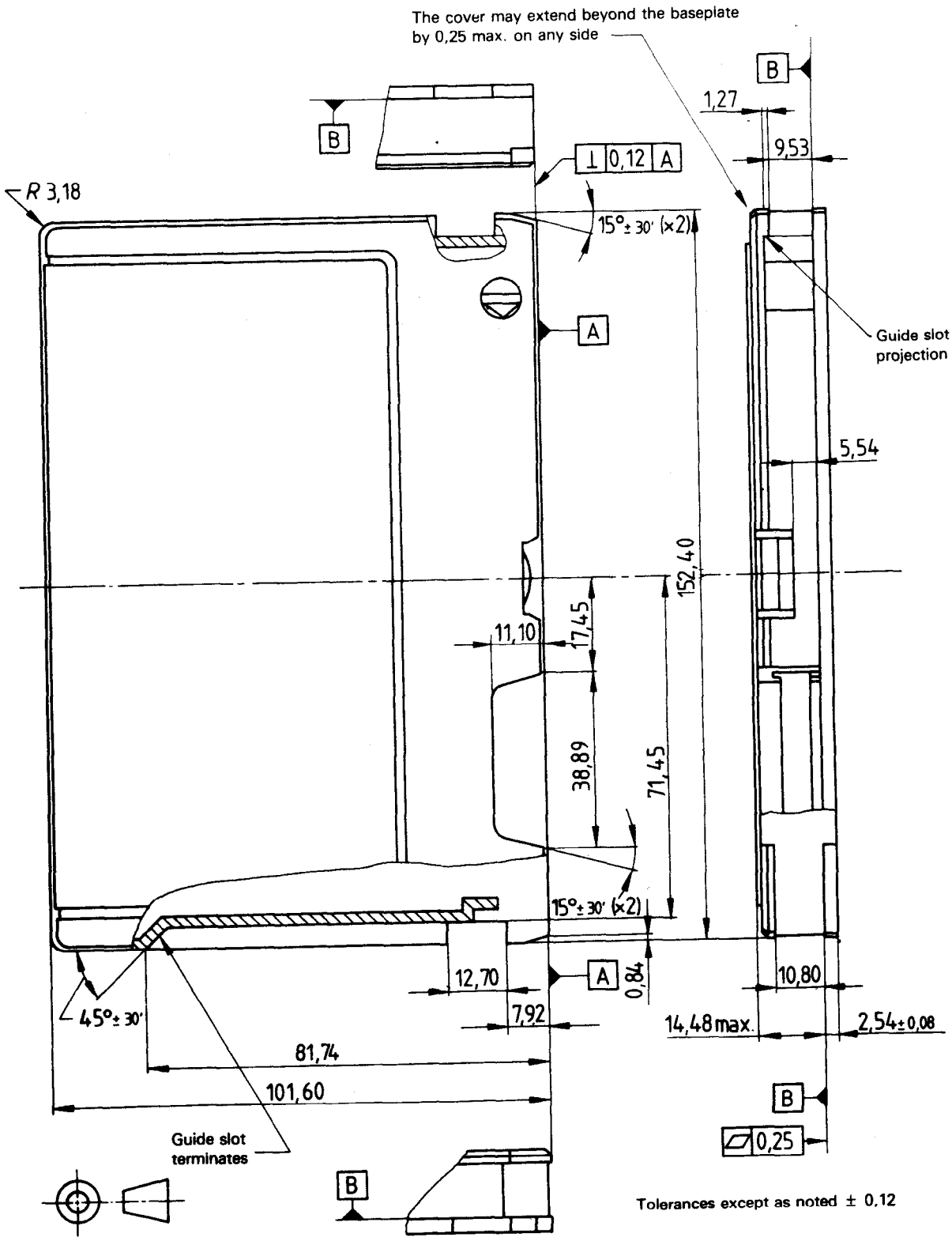


Figure 4a) — Cartridge dimensions

Dimensions in inches

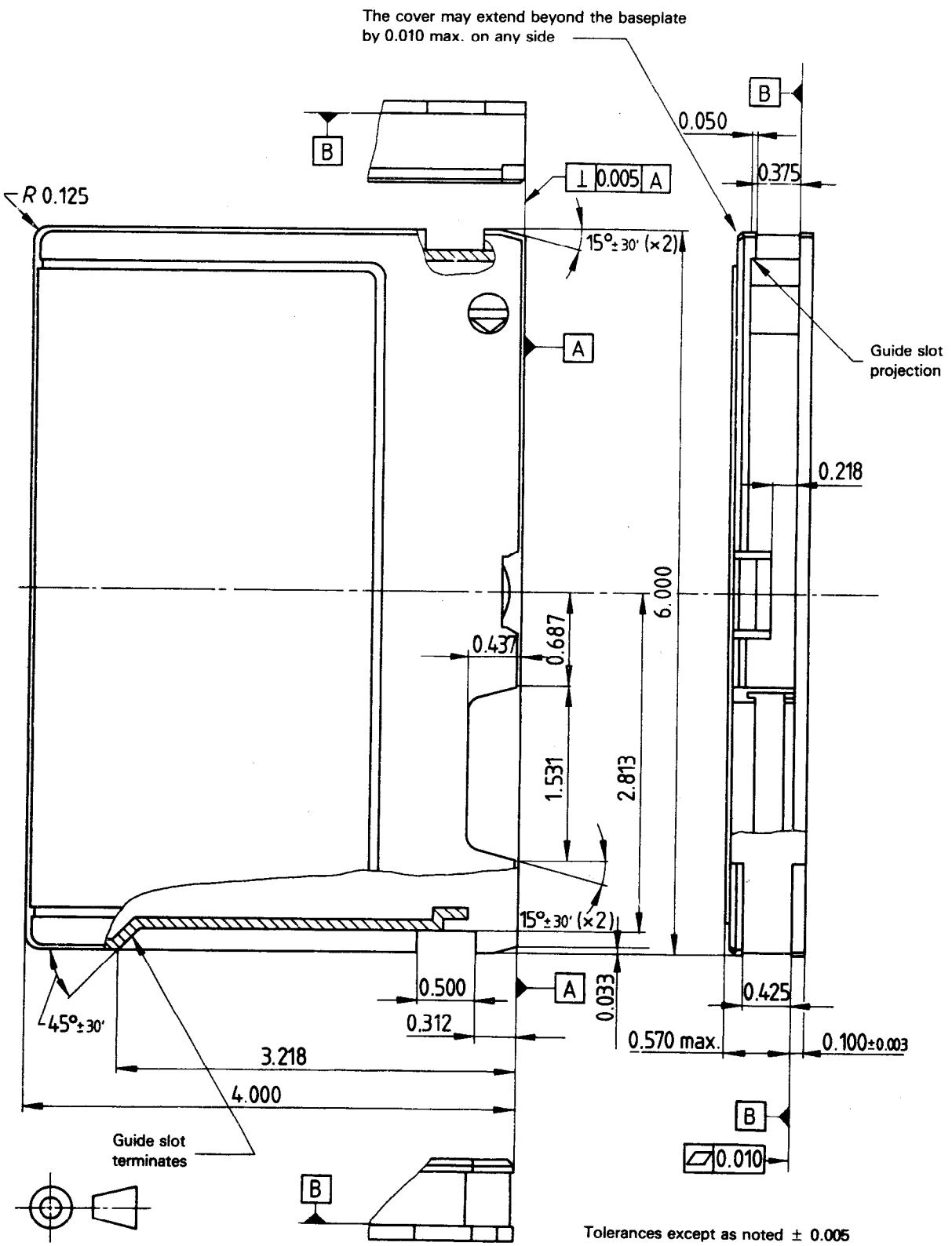
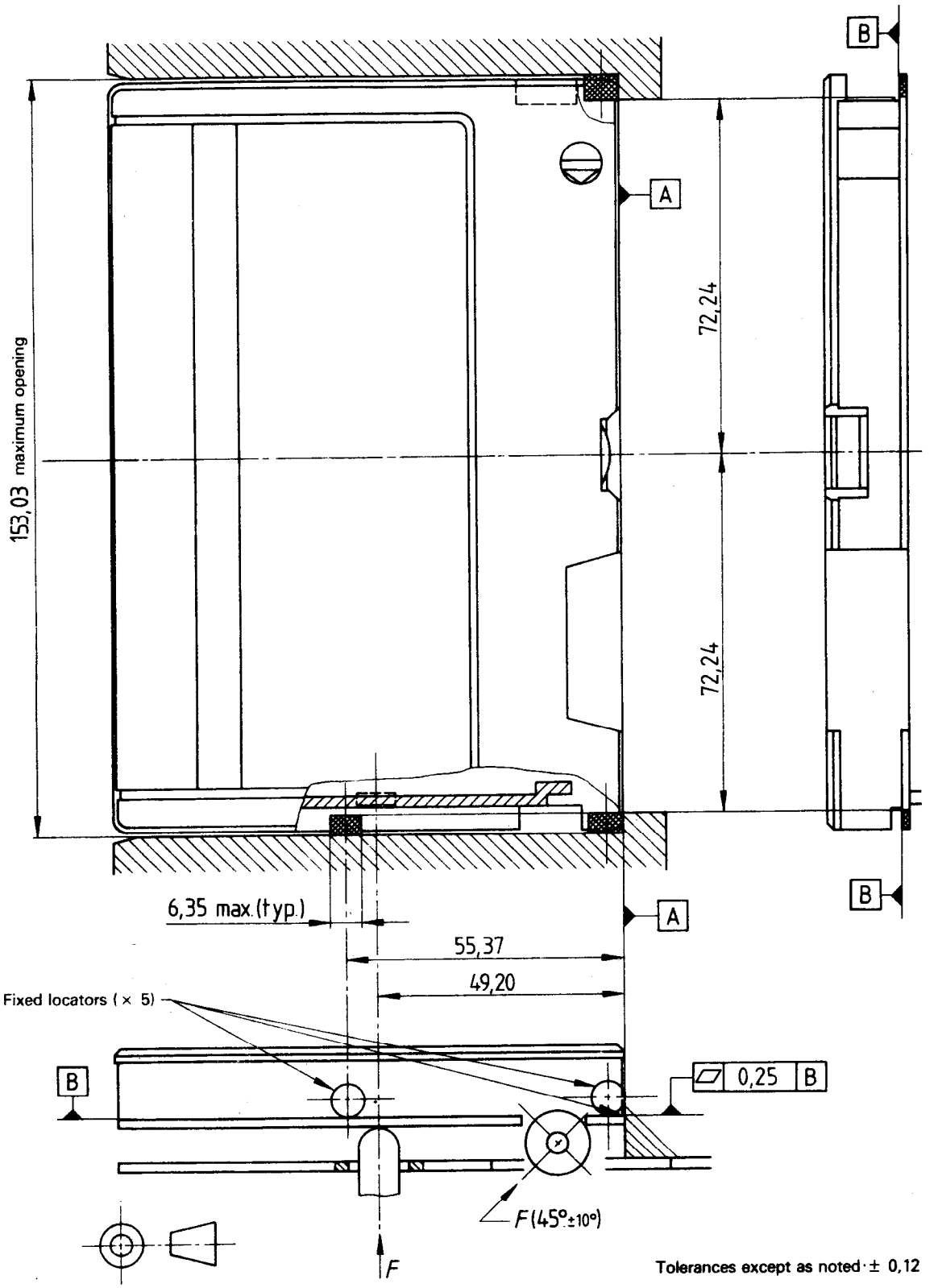


Figure 4b) — Cartridge dimensions

Dimensions in millimetres



Tolerances except as noted ± 0,12

Figure 5a) — Cartridge locating planes

Dimensions in inches

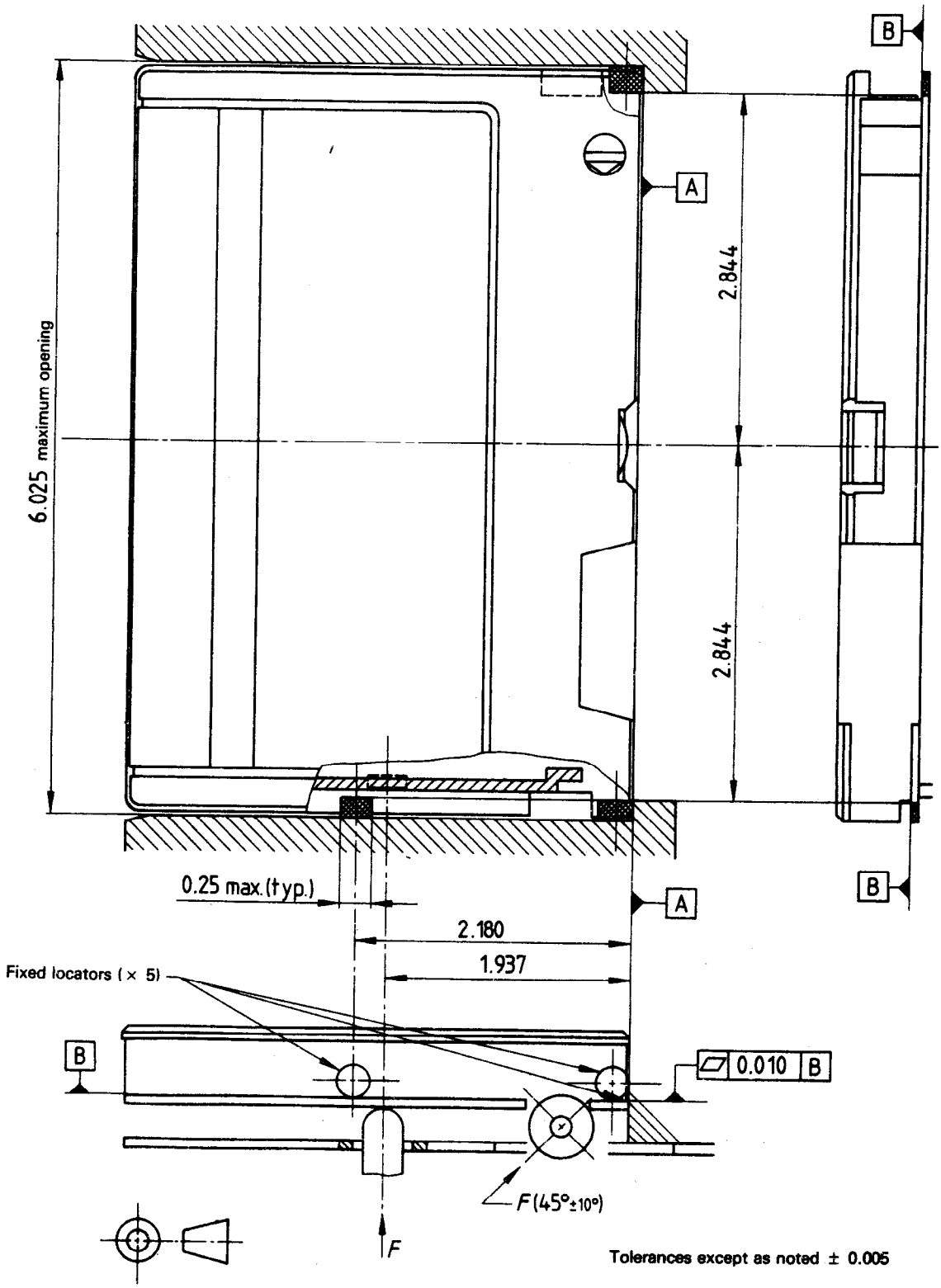


Figure 5b) — Cartridge locating planes

Dimensions in millimetres

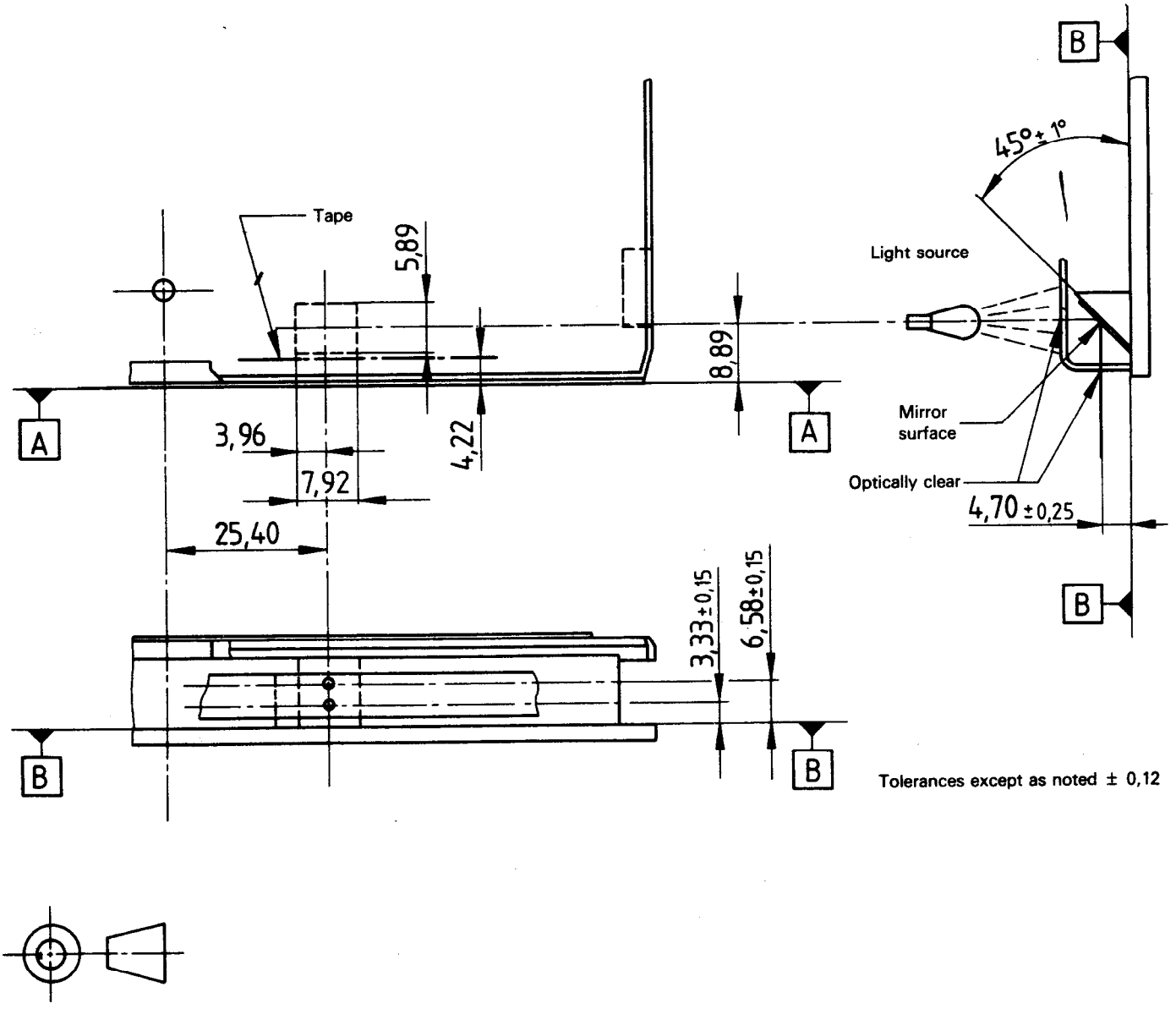


Figure 6a) — Light sensing

Dimensions in inches

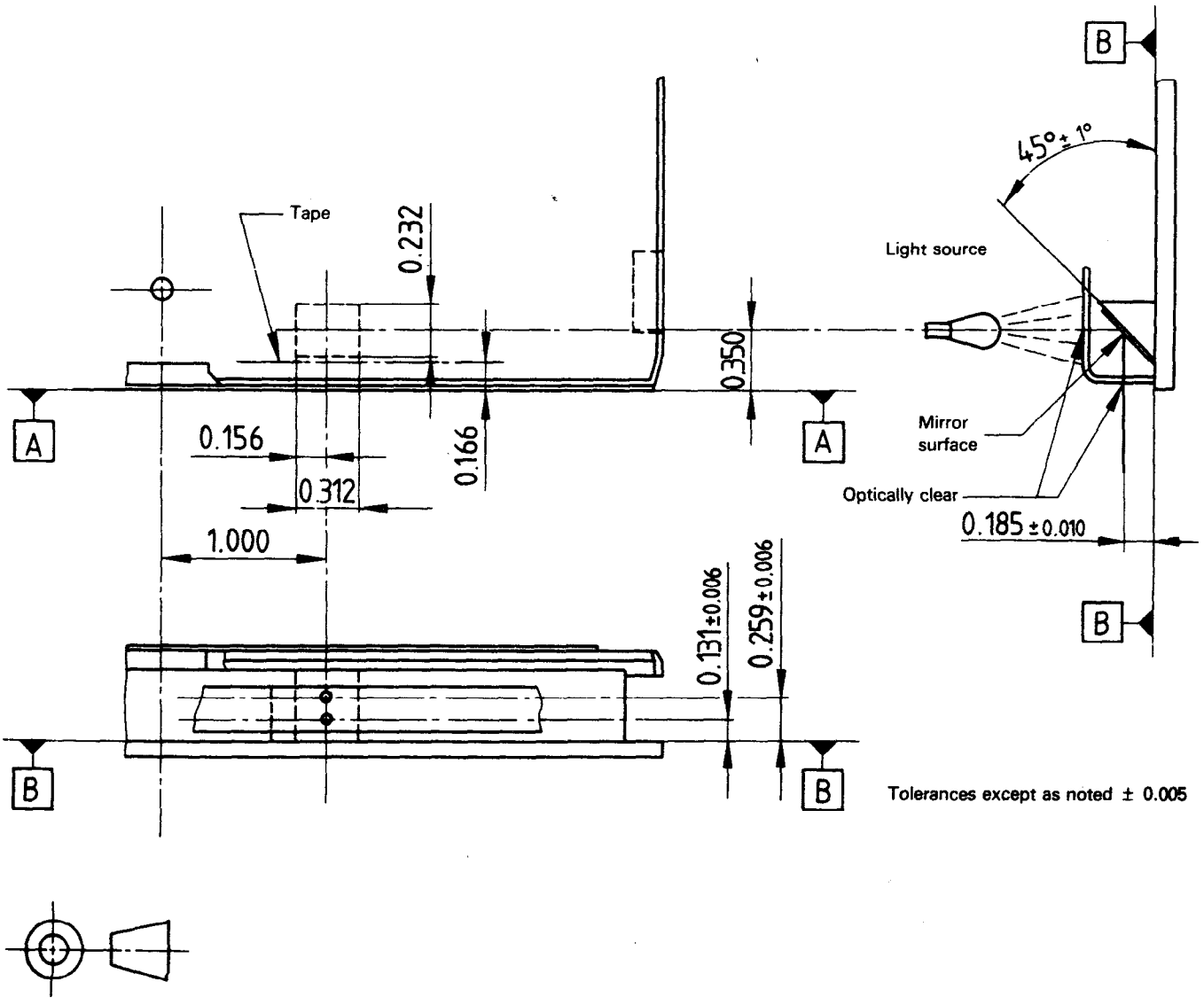
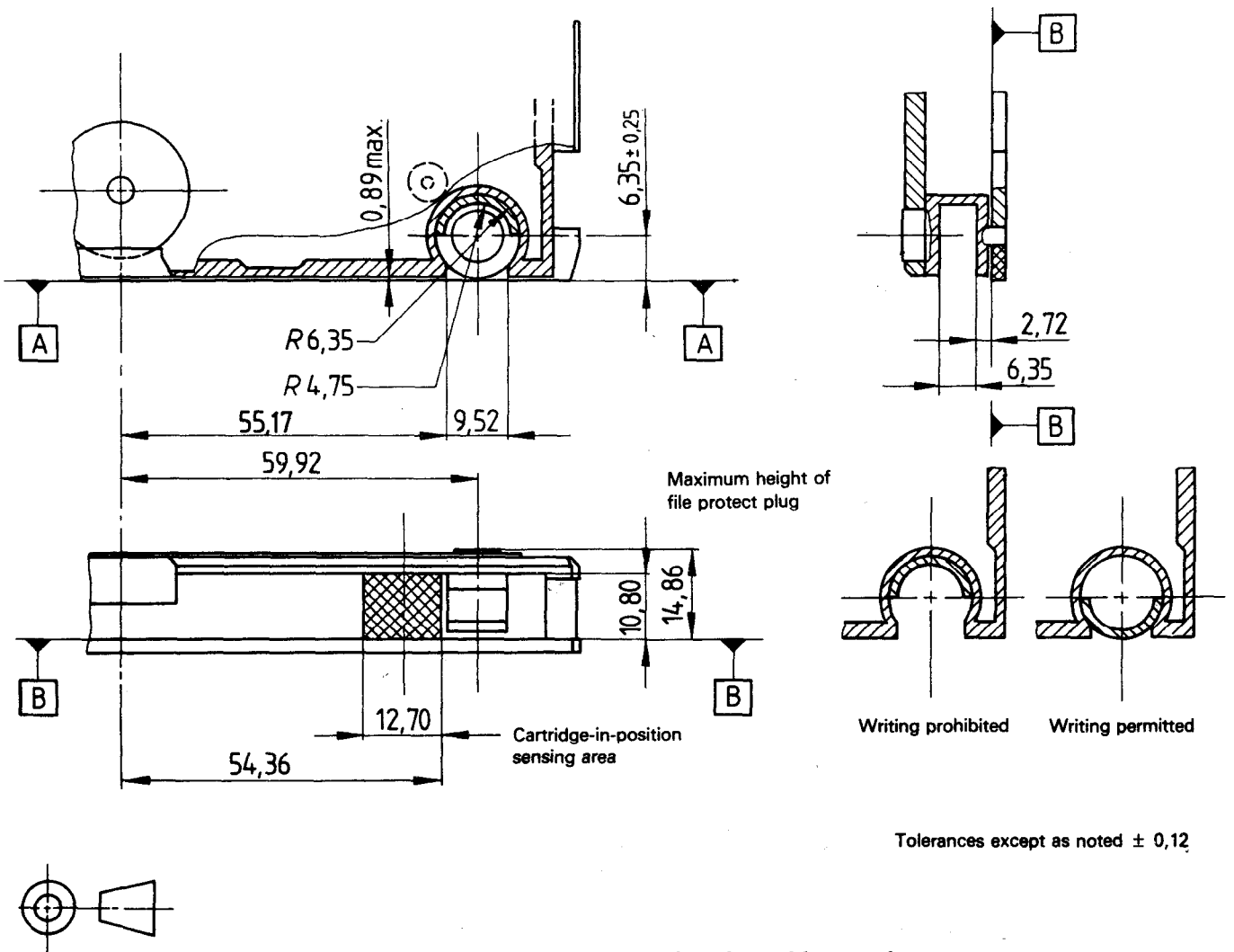


Figure 6b) — Light sensing

Dimensions in millimetres



Tolerances except as noted ± 0,12

Figure 7a) — File protect and cartridge-in-position sensing

Dimensions in inches

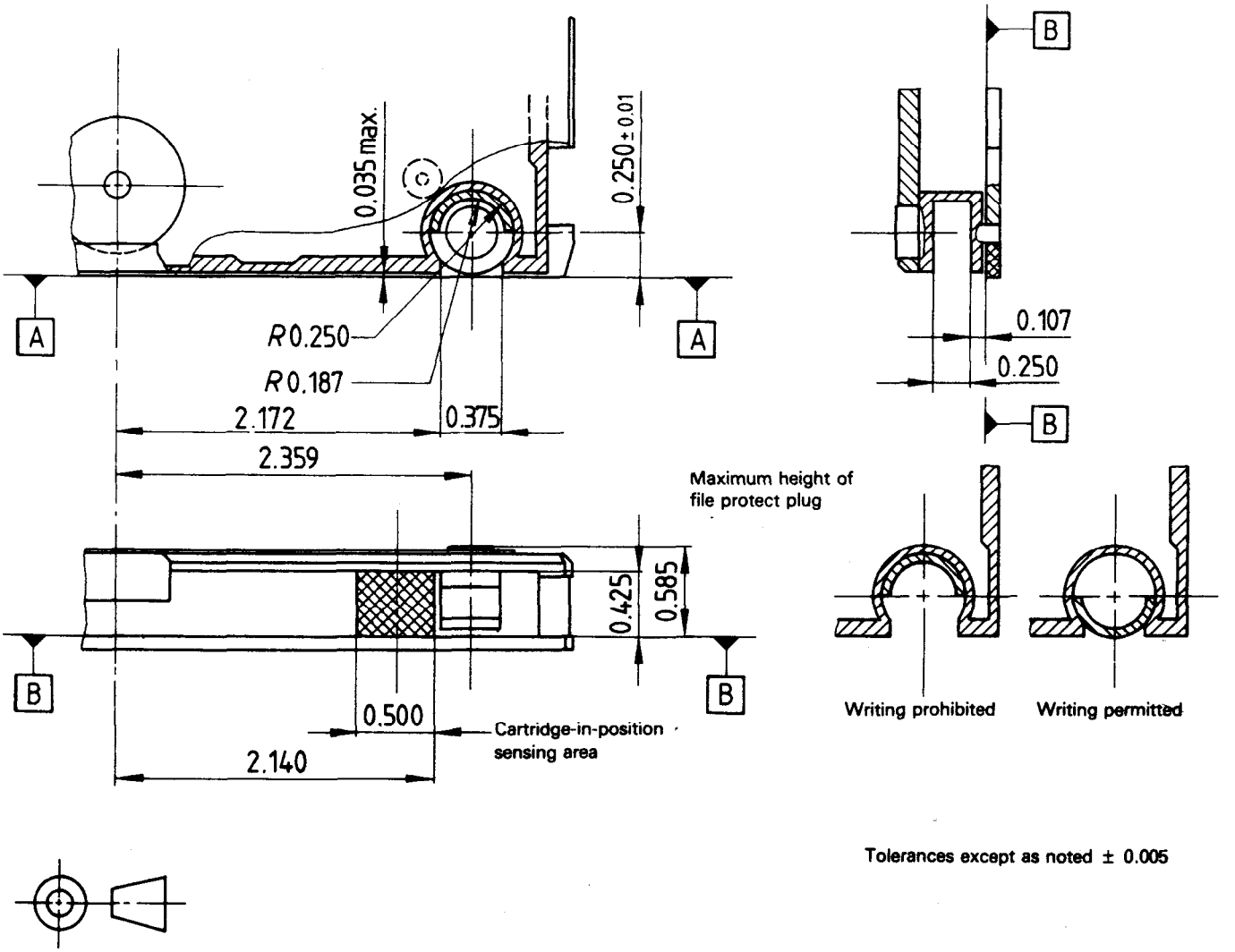


Figure 7b) — File protect and cartridge-in-position sensing

Dimensions in millimetres

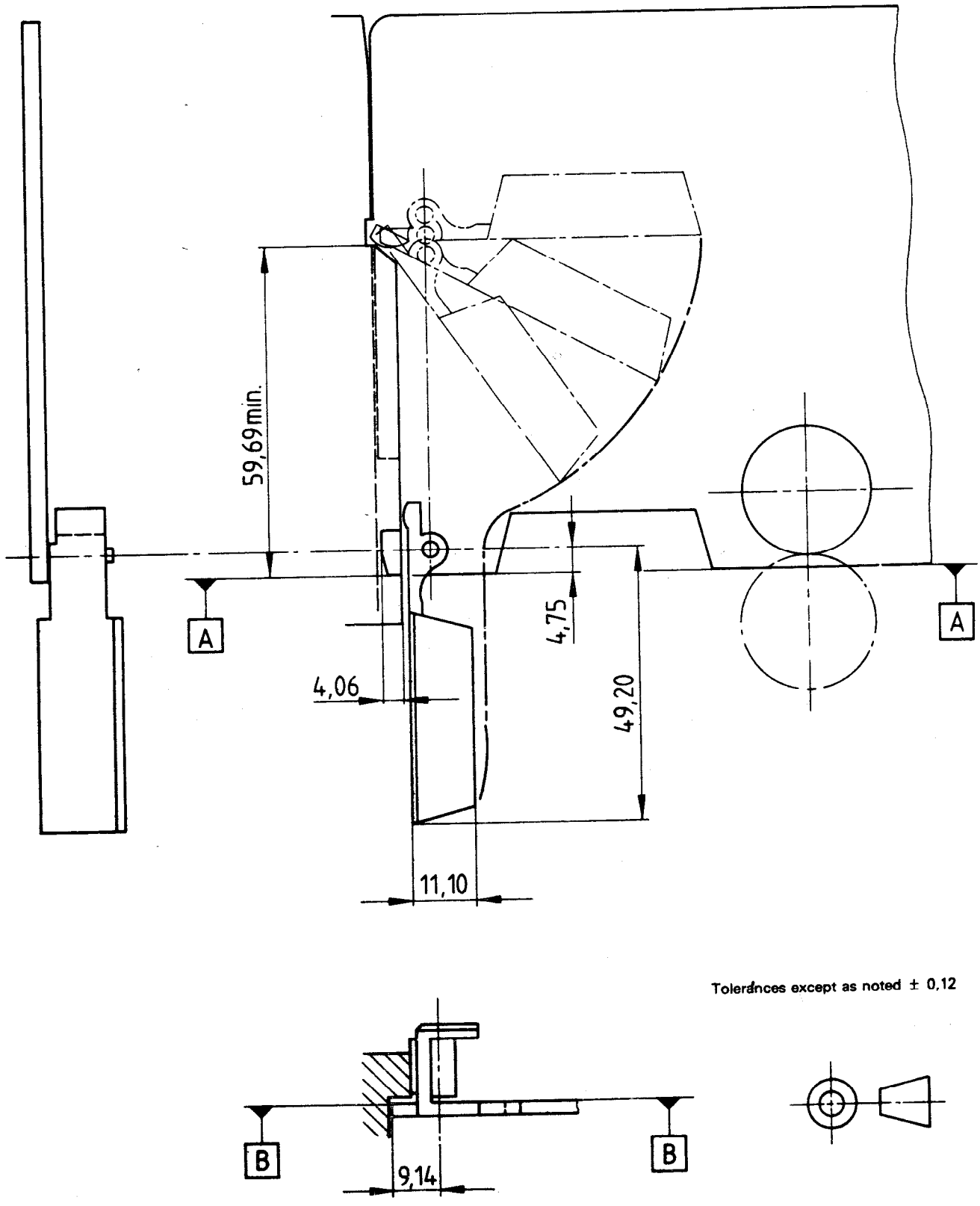
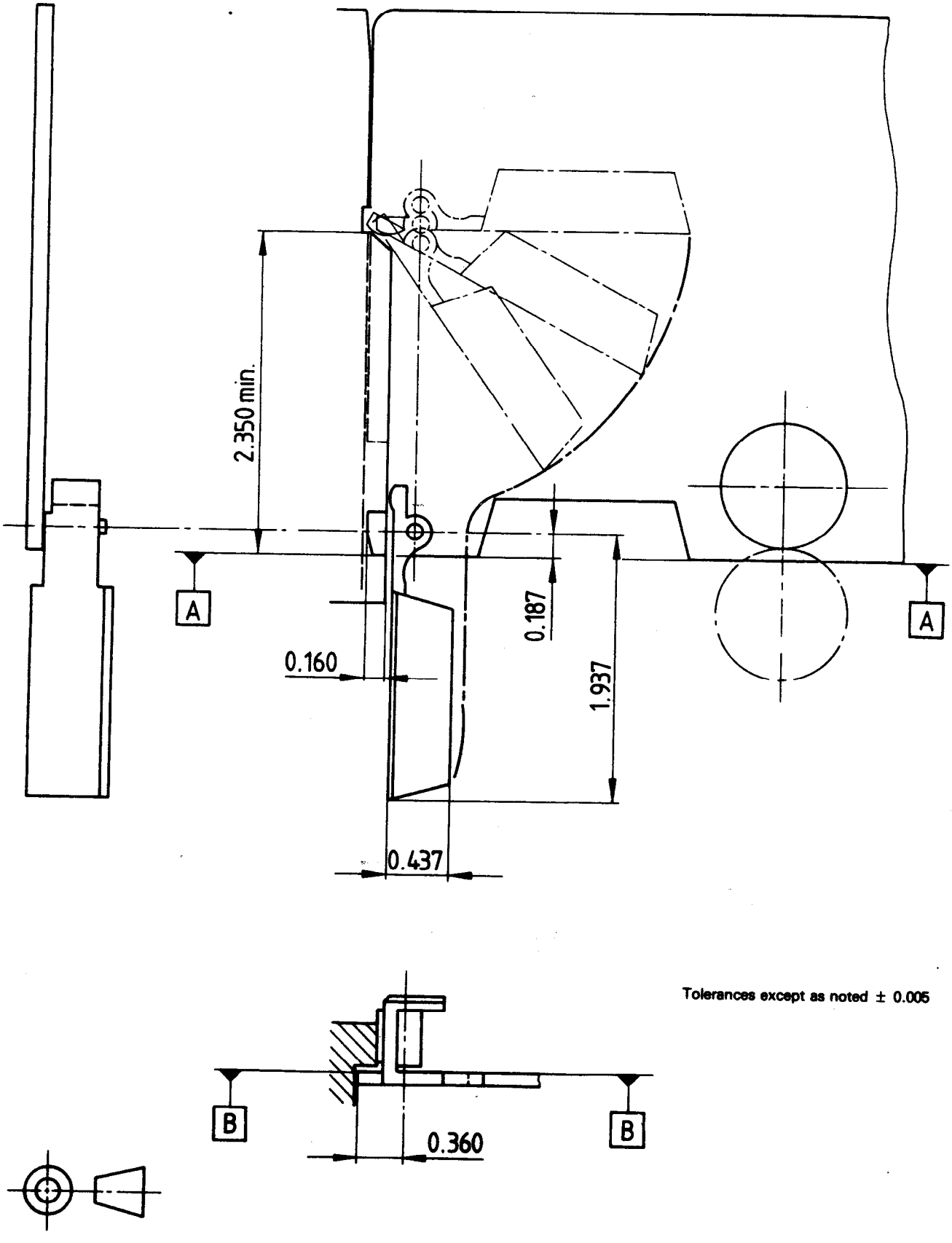


Figure 8a) — Cartridge door profile

Dimensions in inches



Tolerances except as noted ± 0.005

Figure 8b) — Cartridge door profile

Dimensions in millimetres

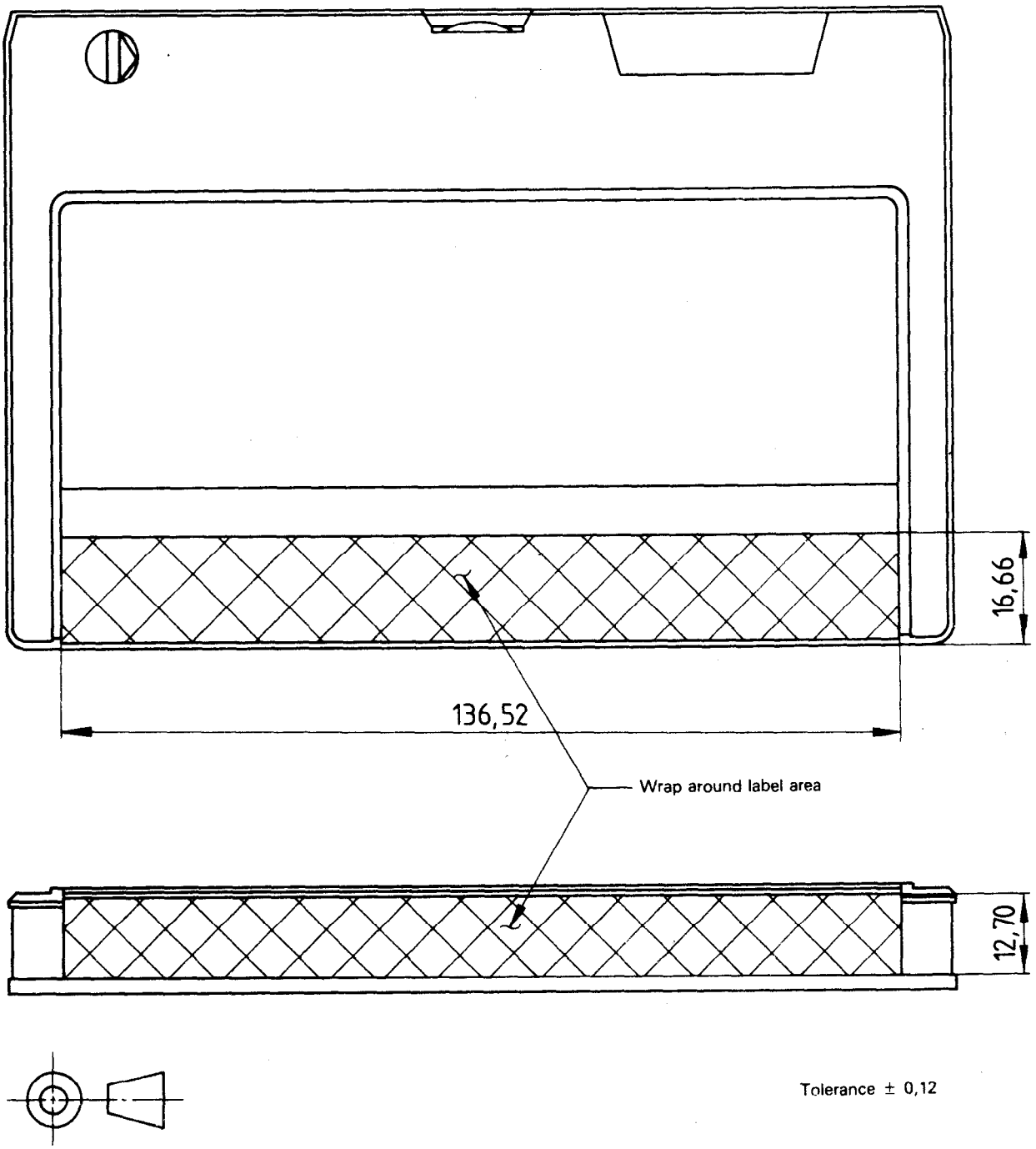


Figure 9a) — Label area

Dimensions in inches

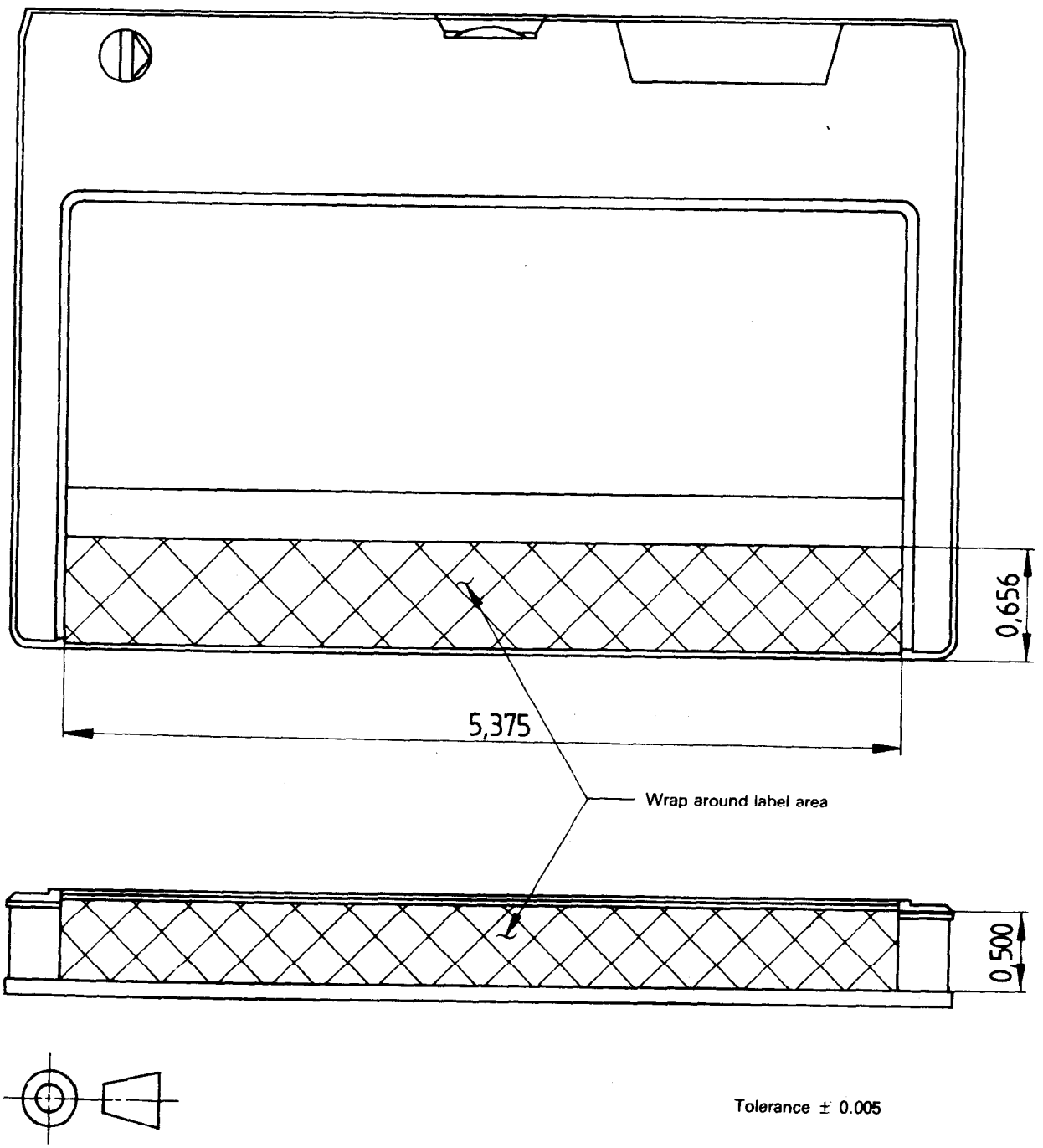


Figure 9b) — Label area

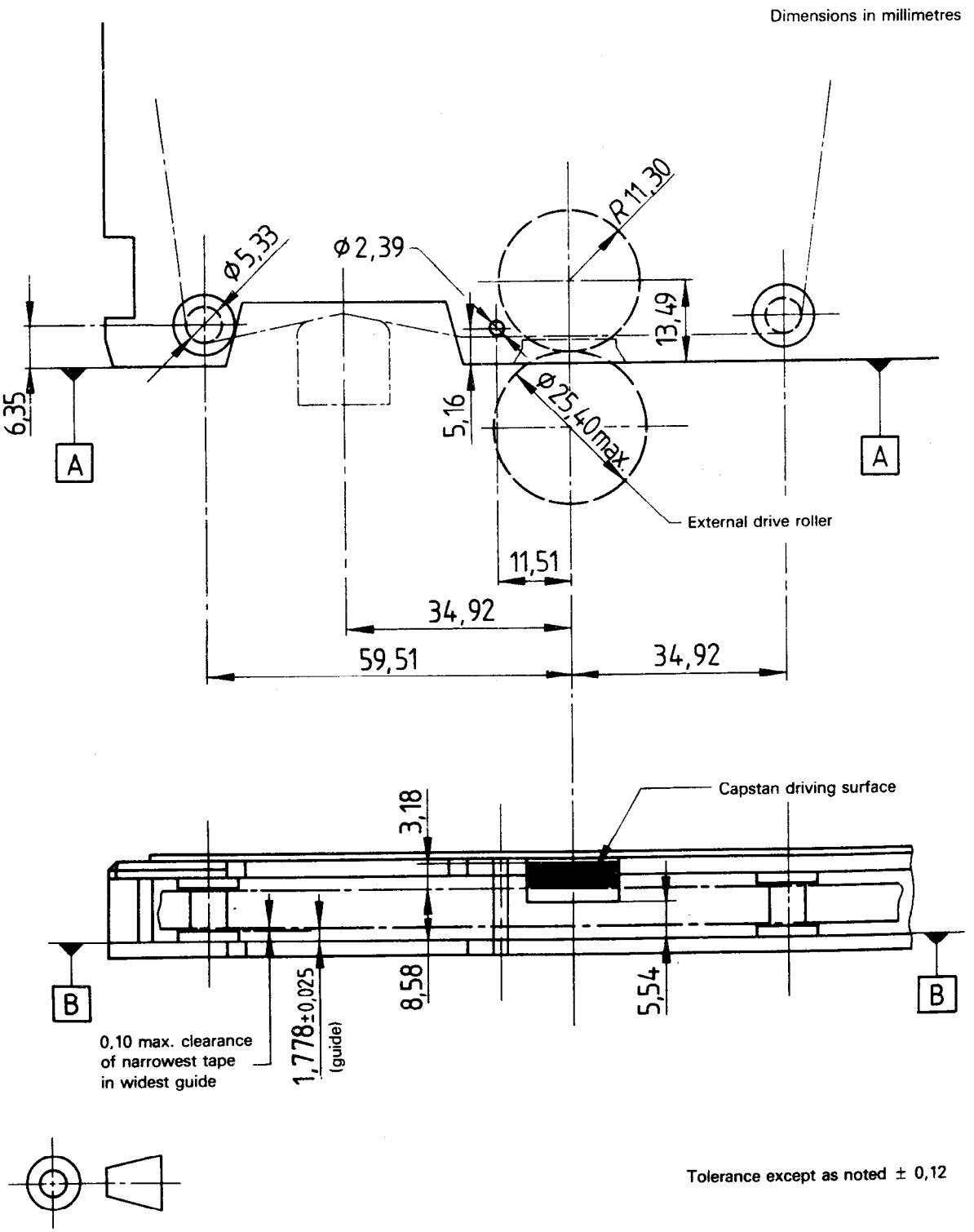


Figure 10a) — Tape path and drive dimensions

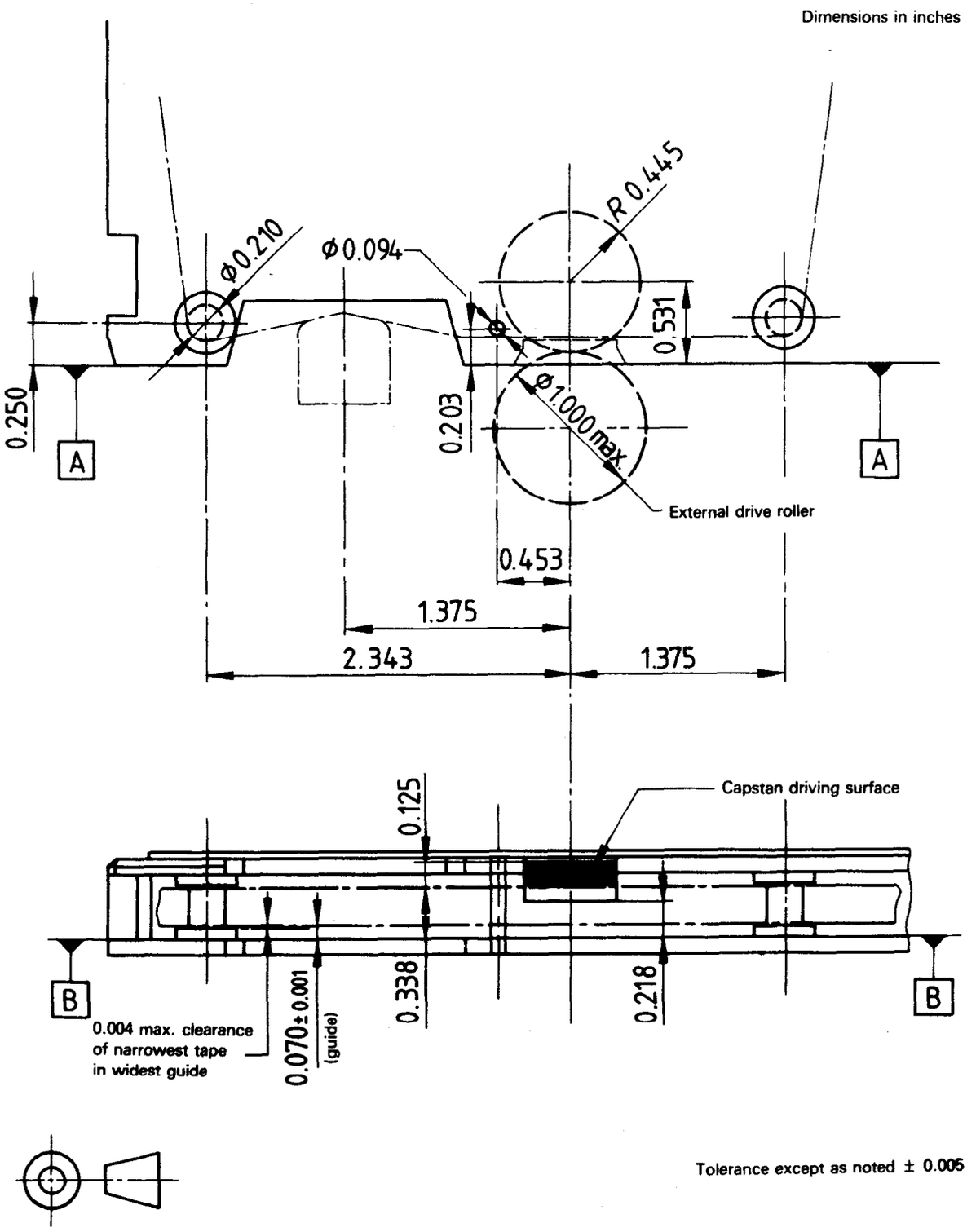


Figure 10b) — Tape path and drive dimensions

Annex A

Measurement of light transmittance

(This annex forms part of the standard.)

A.0 Introduction

Clauses A.2 and A.3 outline the general principle of a test device and the test method for measuring the radiation (light) transmittance of magnetic tape for each of two radiation sources.

For the purpose of this part of ISO 8063 "light transmittance" is defined by convention as the relationship between the reading obtained from the test device with the tape sample inserted and the reading obtained when no sample is present. The transmittance value is expressed as the percentage ratio of the two readings.

The essential elements of the test device are

- the radiation sources;
- the optical path;
- the measuring mask;
- the photocell;
- the measuring equipment.

A.1 Description of the test device

A.1.1 Radiation sources

A tungsten lamp shall be used as one radiation (light) source and should be operated in an under-run state.

The colour temperature should be 2 000 ± 200 K and a resulting illumination at the surface of the tape sample of about 5 000 lx is recommended.

A light-emitting diode is used as the second radiation source. The output wavelength shall be 940 nm ± 50 nm.

A.1.2 Optical path

The radiation should be perpendicular to the tape sample and be of substantially uniform intensity. Typically, the tape sample should be separated from the source by a distance of 150 mm (5.9 in).

An intermediate mask of the form shown in figure 11 is recommended in order to sensibly ensure that scattered radiation does not enter the mask area.

A.1.3 Measuring mask geometry

The measuring mask shall be constructed in one piece as shown in figure 12. A good matt black finish capable of absorbing infra-red radiation is necessary.

Special care shall be taken to ensure that the tape sample to be measured is maintained flat in contact with the inner face of the mask.

A.1.4 Photocell

A flat silicon photocell should be used. Its dimensions shall be such that the active area of the photocell exceeds the diameter of the mask orifice. It should be mounted parallel and in close proximity to the outer face of the mask.

A.1.5 Measuring equipment

The measuring equipment should be connected directly across the photocell to measure the output current. In order to be able to set the measuring equipment to full-scale deflection (100 %), a shunt potentiometer in the circuit shall be provided or a fine adjustment of the lamp power supply voltage is required.

The load impedance across the photocell should be as low as possible and shall not exceed 500 Ω. The instrument should have a nominal accuracy of ± 0,05 %.

A.2 Test procedure

For the purpose of the test use a sample strip of tape not shorter than 250 mm (10 in).

Set the measuring equipment to full scale reading (100 %).

Insert the sample strip and record 45 observations on different points along the sample.

Then withdraw the sample strip and re-check the full scale deflection (100 %). If the reading lies outside the range of 99 % to 101 % reset the equipment to 100 % and record a new set of 45 observations

A statistical maximum value of light transmittance shall be determined using the formula:

$$T = \bar{x} + K \times \sigma$$

where

$\bar{x}$ is the mean value of n observations;

σ is the accurate estimate of the lot standard deviation;

K is the constant specified by the selected plan of inspection;

n is the number of observations on the sample specified by the selected plan of inspection.

The T value, as calculated above, shall be used where inspection of lots of tape is by variables. Lot quality is judged in terms of percent defective and acceptance is lot by lot.

The plan is based upon single sampling (with σ known) and gives

— an Acceptable Quality Level (AQL) of 0,5 % defective, and a

— lot tolerance percent defective (LTPD) of 1,26 %.

The selected plan has a sample size letter of O and gives the values for

K = 2,33, and

n = 45[1)]

If $T < T$ max., the lot is accepted; if $T > T$ max., the lot is rejected (where Tmax., is the maximum value of transmittance permitted).

A.3 Guidance on construction

A.3.1 Experience has shown that a projector lamp is most suited as the tungsten source. When selecting a lamp, care shall be taken to avoid a lamp with optical inhomogeneities in the glass envelope. Also, if mirrors or lenses are used in the optical path, they shall be placed so that no filament image occurs in the proximity of the mask and photocell area. Radiation sources shall be operated from a stabilized, regulated power supply.

A.3.2 Special attention shall be paid to all surfaces parallel to the optical path and in close proximity to the mask and photocell to avoid reflection of light. Similarly, the method of inserting the tape shall ensure that no ambient light leaks through any slot arrangement.

A.3.3 The accuracy of the measurement is dependent not only on attaining the dimensional tolerances shown in figure 12, but also on the subsequent coating of the surfaces with a high quality optical matt black paint. The mask should be checked after coating to ensure that the small hole remains within the tolerance. The method of holding the sample shall be such that the tape is maintained flat in contact with the face of the mask. However, it shall allow the sample to be moved without physical damage or distortion.

A.3.4 The photocell shall be mounted with care, taking special precaution that the photocell leads do not interfere with the mounting arrangement. It is advisable that the face of the photocell presses slightly on the outer face of the mask.

A.3.5 An effective means of providing periodical calibration should be incorporated by inserting an opaque object for 0 % light transmittance and a filter glass for 75 % light transmittance.

A.3.6 The test device should be cleaned periodically.

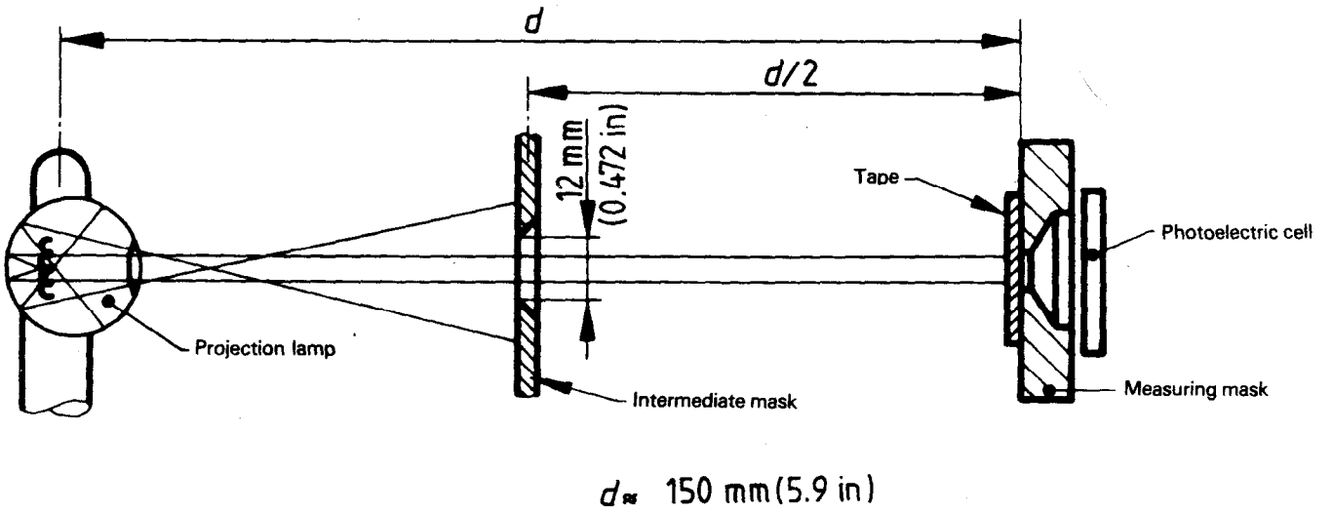
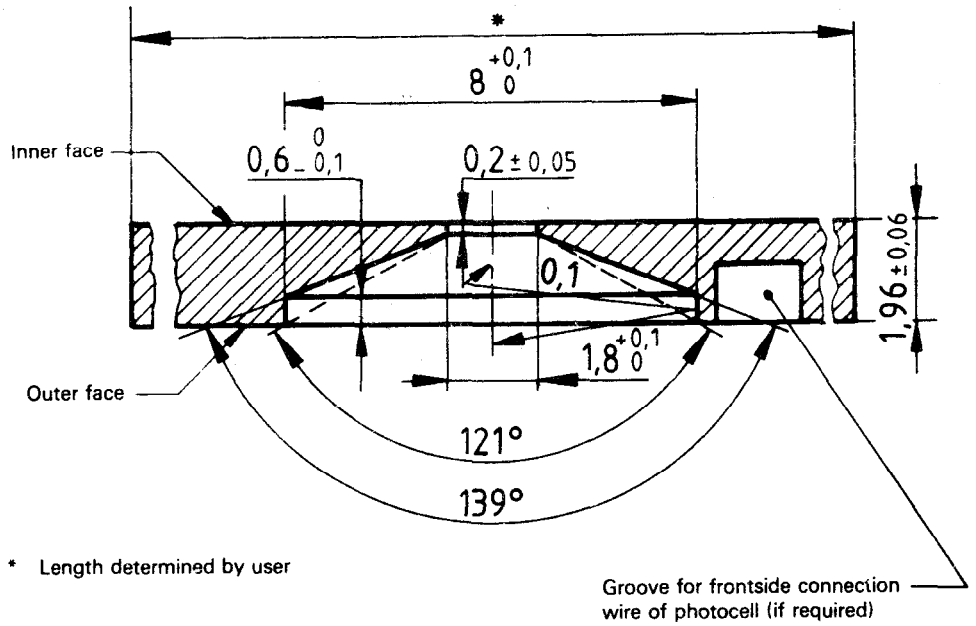


Figure 11 — Measuring device

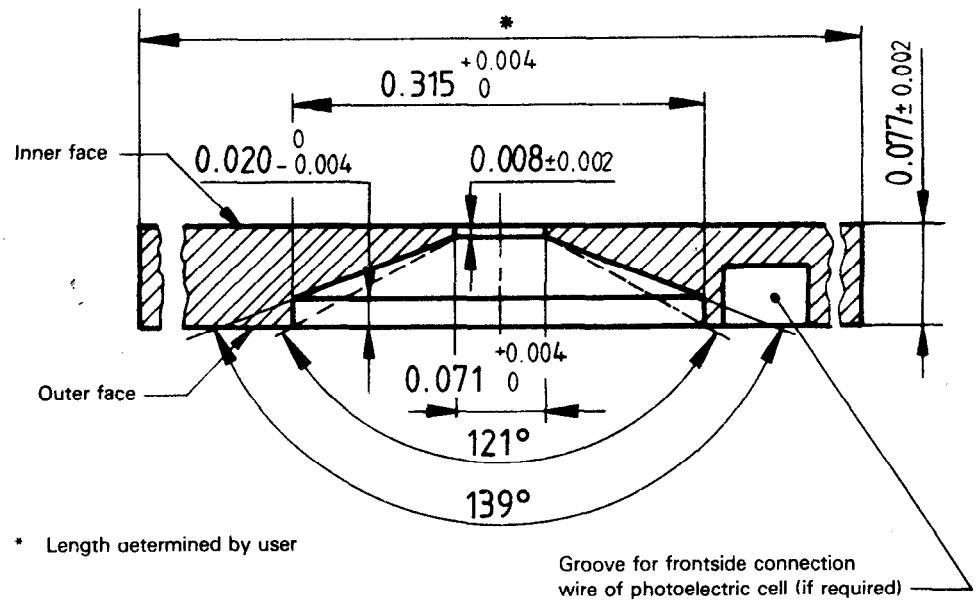
A.H. BOWKER and H.P. GOODE, *Sampling Inspection by Variables,* McGraw-Hill, 1952.

Dimensions in millimetres



* Length determined by user

Dimensions in inches



* Length determined by user

Figure 12 — Measuring mask

Annex B

Layer-to-layer adhesion

(This annex forms part of the standard.)

The procedure for testing the tape for layer-to-layer adhesion is as follows:

A piece of the tape to be tested, about 1 m (39 in) in length, shall be wound around a glass pipe, 36 mm (1.42 in) in diameter, with a tension of 3 N (0.67 lbf) and fixed at the end. This shall be stored for 24 h at a temperature of 45 ± 3 °C (113 ± 5 °F) and at a relative humidity of 80 %. After this period it shall be stored for another 24 h in the testing environment specified in 5.1. The tape shall then be unwound with a mass of 8,3 g (0.29 oz) at the end of tape as shown below, and the angle (Θ) shall be smaller than 45°.

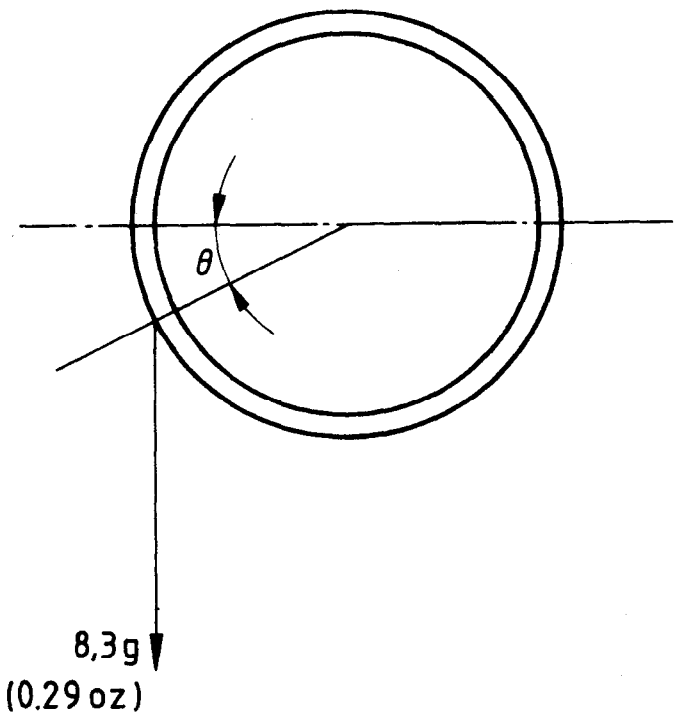


Figure 13 — Test for layer-to-layer adhesion

Annex C

Instantaneous speed variation

(This annex forms part of the standard.)

C.1 General

When a tape is recorded at constant frequency, F_0, and played back, the frequency of the recovered signal will not be constant but will in general be $F_0 \pm \triangle F$.

$\triangle F/F_0$ is defined as Instantaneous Speed Variation (ISV) and can be resolved into a series of frequency components f_1, f_1, ..., f_K, each of magnitude α_1, α_2, ..., α_K, i.e.:

$$\sum_{i=1}^{K} \alpha_i \sin 2\pi f_i t$$

Due to this ISV, any flux transition will not be in its expected time location, but will exhibit a shift ($\triangle t$). This shift is defined as Time Displacement Error (TDE). It can be shown that, for any given component of ISV, the resultant TDE is

$$\frac{\alpha_i}{2\pi f_i} \sin 2\pi f_i t$$

with a peak value of

$$\frac{\alpha_i}{2\pi f_i}$$

A data separator phase-locked loop will normally follow the TDE and reduce it to some residual value (Residual TDE). The degree of reduction (suppression) is equal to $(1 + G)$, where G is the open-loop gain at the frequency of interest. Hence, residual TDE for a given frequency is

$$\mathrm{TDE_R} = \frac{\alpha_i}{2\pi f_i} \frac{1}{1 + G_i}$$

For the purpose of defining allowable TDE for interchange, a standard phase-locked loop gain of the form

$$G = \left(\frac{f_n}{jf}\right)^2 \left(1 + j\sqrt{2}\,\frac{f}{f_n}\right)$$

is established, leading to a suppression function of

$$\frac{1}{1 + G} = \frac{\left(\frac{jf}{f_n}\right)^2}{1 + j\sqrt{2}\,\frac{f}{f_n} + \left(\frac{jf}{f_n}\right)^2}$$

The magnitude of the suppression function is

$$\frac{1}{1 + G} = \frac{\left(\frac{f}{fn}\right)^2}{\sqrt{\left[1 - \left(\frac{f}{fn}\right)^2\right]^2 + 2\left(\frac{f}{fn}\right)^2}}$$

This is shown as a function of frequency in figure 15:

$fn - F_0 / 17$

NOTES

1 For tape speeds other than 0,76 m/s (30 in/s), the natural frequency of the loop may be scaled linearly.

2 The maximum allowable single-frequency ISV which would result in a value of TDE within the specifications is shown in figure 16.

C.2 Test circuit

The standard loop (see figure 14) shall be designed as follows:

$$\frac{K_1 K_2}{CR_1} = (2\pi f_n)^2 = 1{,}25 \times 10^9$$

$$CR_2 \neq \frac{1}{2\pi \times 4 \times 10^3}$$

$$\mathrm{TDE_{OUT}} = \frac{1}{K_1 f_0} \text{ s/V}$$

$f_0 = 96$ kHz

C.3 Method of test

Record the tape with a constant recording density o 252 ftpmm (6 400 ftpi) full length on two tracks.

Read the tape signals at 0,76 m/s (30 in/s), using the squar wave output from the read channel connected to the input o the standard loop.

Count the TDE events which exceed 156 ns [3 % of the nomi nal cell time at 252 ftpmm (6 400 ftpi)].

TDE events within 12,7 mm (0.5 in) shall be considered as single event. TDE events caused by missing pulses shall b ignored.

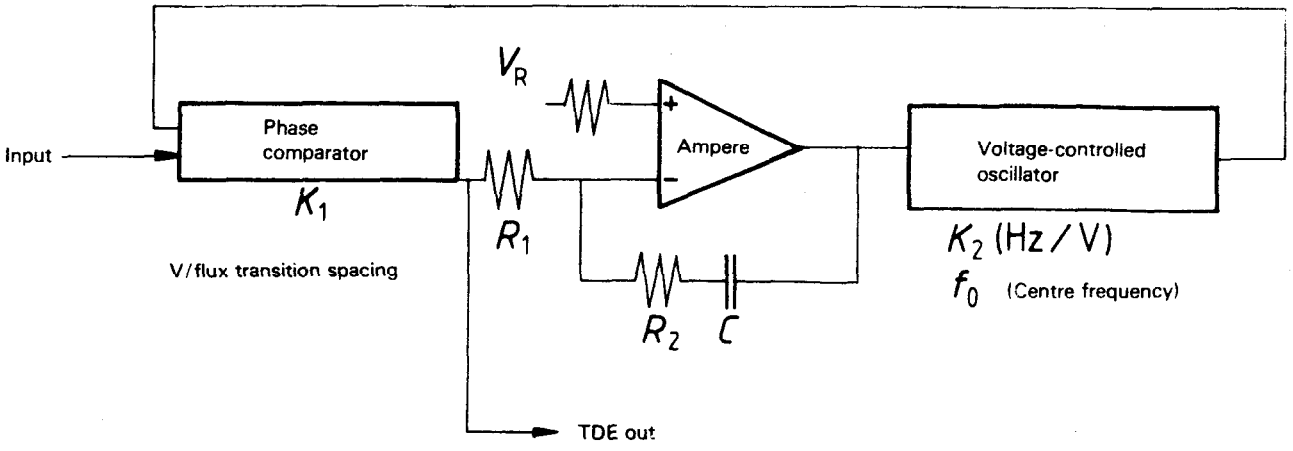


Figure 14 — Standard loop

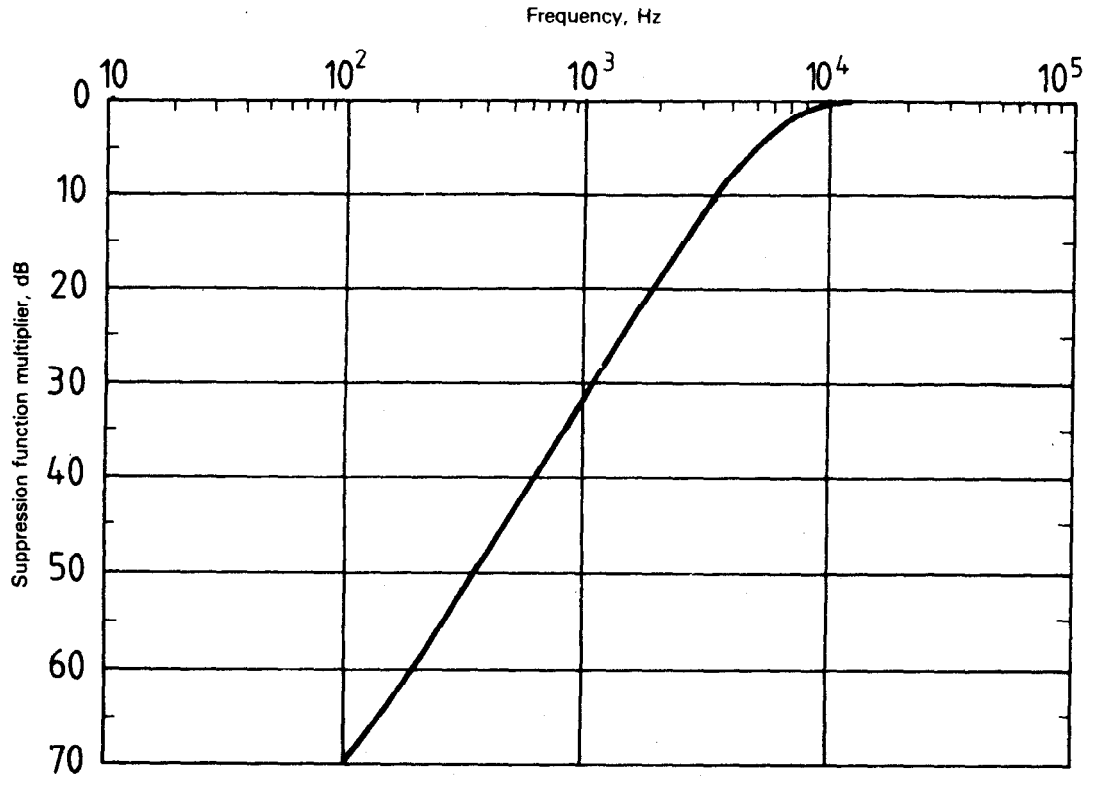


Figure 15 — *Suppression function*

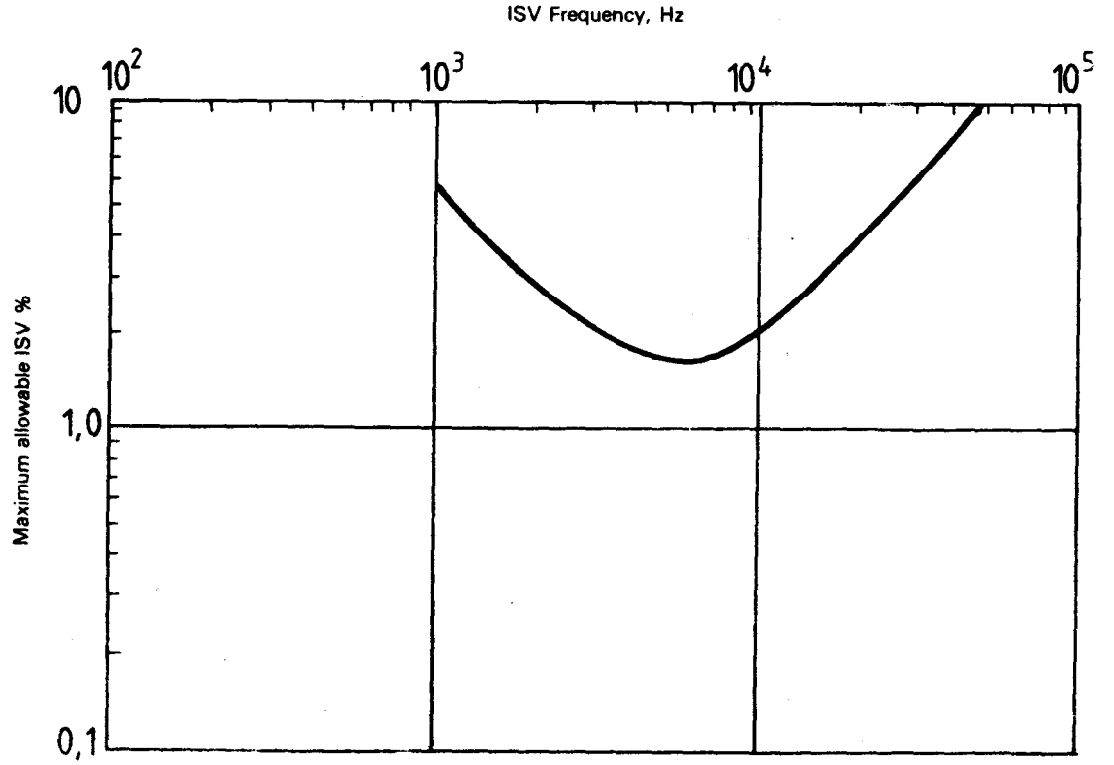


Figure 16 — Maximum allowable ISV

Annex D

Tape tension

(This annex forms part of the standard.)

D.1 Test procedure for measuring instantaneous tension

D.1.1 Conditioning

Condition the tape before testing by winding at 2,29 m/s (90 in/s) from BOT to EOT, and back to BOT.

D.1.2 Tape speed

The tape speed during testing shall be 0,76 m/s (30 in/s).

D.1.3 Position of the measuring transducer

The measuring transducer shall be positioned at the point along the free tape path at which the head would be located if the cartridge were mounted in a drive.

When inserted in the tape path it shall cause an increase in the tape path length within the limits of 8.13.

It shall be perpendicular to the reference plane B ± 1°.

D.1.4 Characteristics of the measuring transducer

The coefficient of friction of the bearing surface shall be less than 0,1.

The upper limit of its frequency response shall be at least 100 Hz.

The width of the bearing surface shall be sufficient for it to be in contact with the whole width of the tape.

D.2 Test procedure for measuring tape tension variation

D.2.1 Conditioning

Condition the tape before testing by winding at 2,29 m/s (90 in/s) from BOT to EOT and back to BOT.

D.2.2 Position of tape for measurement

The cartridge shall be held with reference plane B vertical, and the cartridge door on top and in the open position.

The tape shall remain stationary at the selected point.

D.2.3 Characteristics of the test rod

The form and dimensions of the test rod are given in figure 17.

The mass of the test rod shall be 14 g (0.5 oz).

A suitable material is aluminium.

The centre of gravity shall be within 0,13 mm (0.005 in) of a vertical line through the centre of the notch.

Check the balance by placing the notch on a level edge 0,20 to 0,25 mm (0.008 to 0.010 in) wide. The test rod shall not deviate from the horizontal by more than 1°.

Material may be trimmed from one end of the rod to achieve the required balance.

D.2.4 Position of the test rod

The slot of the test rod shall be centred over the point along the free tape path at which the head would be located if the cartridge were mounted in a drive.

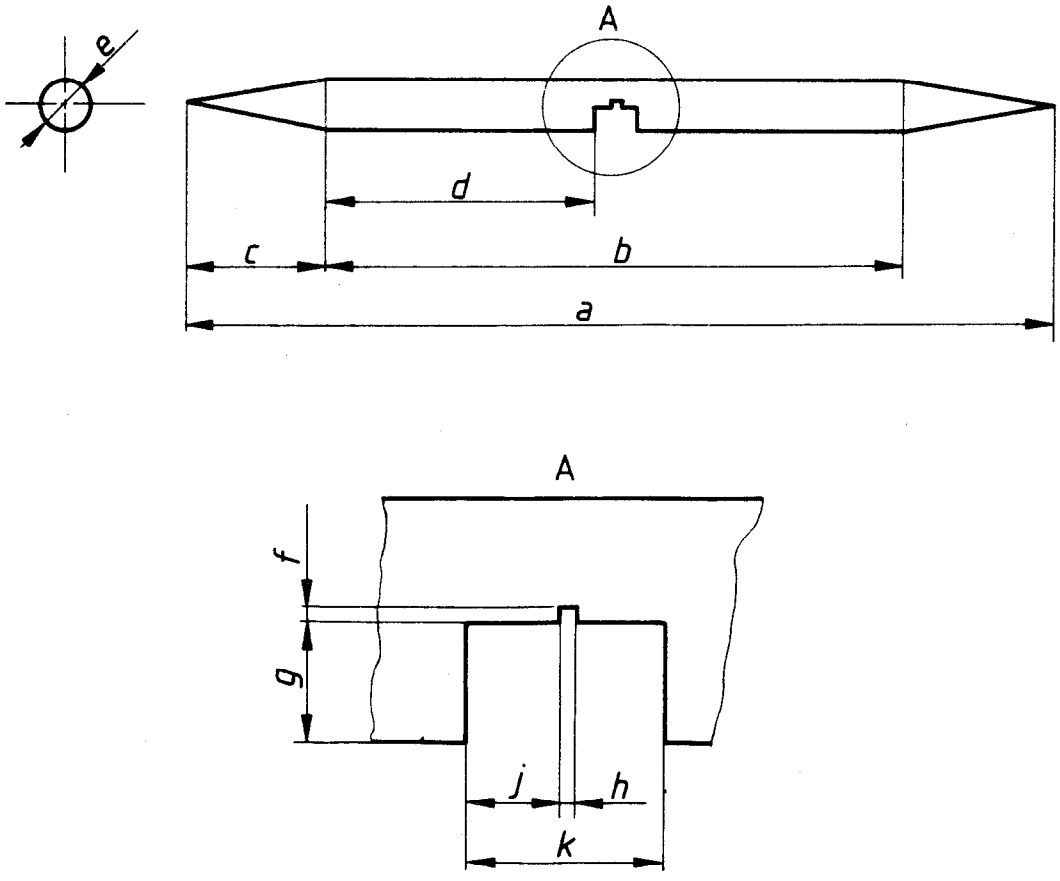


Figure 17 — Test rod

Table — Dimensions of the rod

	Millimetres	Tolerance	Inches	Tolerance
a	138,43		5.450	
b	90,78		3.574	
c	23,82		0.938	
d	42,21	± 0,13	1.662	± 0.005
e	7,92		0.312	
f	0,25		0.010	
g	3,96		0.156	
h	0,279		0.011	
j	3,023	± 0,025	0.119	± 0.001
k	6,325		0.249	

Annex E

Electrical resistance of the belt capstan

(This annex forms part of the standard.)

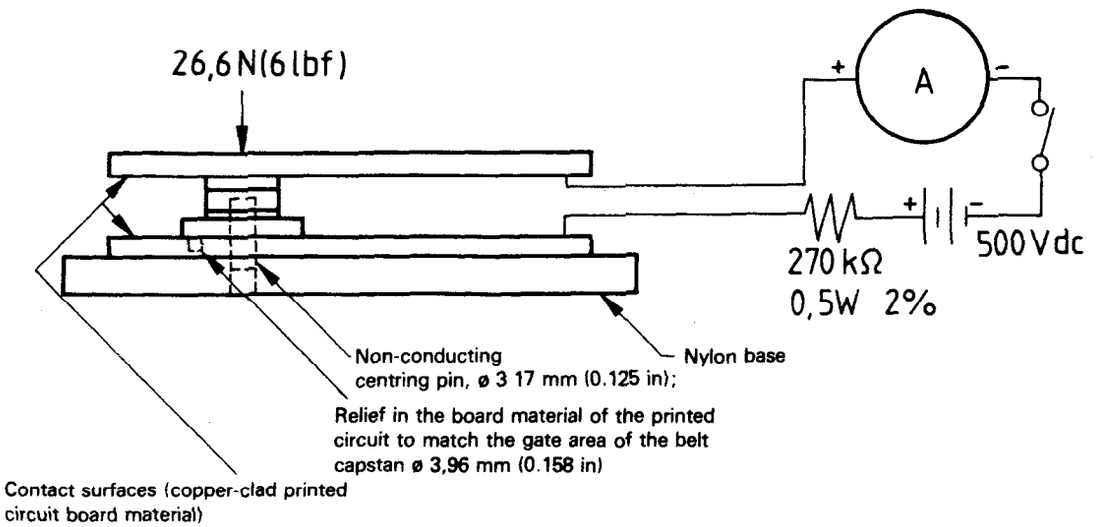


Figure 18 — Test fixture

E.1 Procedure

Ensure that the contact surfaces of the belt capstan and the test fixture are clean and free from oil, grease, tarnish or other contaminants before making the test.

Place the belt capstan on the centring pin of the bottom contact surface, with the gate area over the relief.

Place the upper contact surface on top of the belt capstan and apply a force of 26,6 N (6 lbf) centrally over the capstan.

Measure the current flowing in the circuit when a potential of 500 ± 5 V is applied.

E.2 Test result

The current shall be 0,40 mA min.

Annex F

Defect density

(This annex forms part of the standard.)

F.0 Introduction

To assess the number of rejected regions to be expected in any application for this cartridge at the time of interchange, the concept of defect density has been introduced.

F.1 Definitions

F.1.1 Rejected Region: A length of track of 25,4 mm (1.0 in) in which one or more missing pulses have been detected.

F.1.2 Track Width (TW): The width of the recorded signal sensed by the Read Head.

F.1.3 tested surface area: That surface containing recorded signals, exclusive of erased gaps or other non-used recording areas where missing pulses are not detectable.

It is the product of TW and the total length of tracks tested.

F.1.4 defect density: The number of Rejected Regions observed, divided by the tested surface area.

It is expressed as defects per square millimetre (D/mm^2) or defects per square inch (D/in^2).

F.1.5 Threshold Level (TL): The TL is measured relative to the Standard Reference Amplitude (SRA_{252}) and is expressed as a percentage of the SRA.

F.1.6 Effective Defect Diameter (EDD): The EDD is calculated as follows

$$EDD = (1 - TL/100) \times TW$$

F.2 Requirements

The cartridge shall meet the following requirements:

The Defect Density shall be less than, or equal to,

$$0{,}034\ 1 \times e^{(-19.3\ EDD)}\ D/mm^2\ [22 \times e^{(-490\ EDD)}\ D/in^2]$$

F.3 Procedure

The test is performed in-contact over the tested surface area.

F.4 Example

F.4.1 Data

Read track width:	0,46 mm (0.018 in)
Threshold level:	40 %
Number of tracks:	4
Tested track length:	138 836 mm (5 466 in)

F.4.2 Calculation

$$EDD = 0{,}46\ (1 - \frac{40}{100}) = 0{,}276 \text{ mm } (0.010\ 8 \text{ in})$$

Defect density: < 0,000 17 D/mm^2 (0.11 D/in^2)

Tested surface area = 138 836 × 0,46 × 4 = 255 458 mm^2 (396 in^2)

Maximum number of rejected regions = 0,000 17 × 255 458 = 44

F.4.3 Conclusion

The result in F.4.2 indicates that the maximum number o rejected regions is 44 for a cartridge operated under the give conditions. Cartridges with more than this number shall not b used for interchange.

Reprography Unit, BIS, New Delhi, India